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CONTENTS

THE FLEET. By Rear-Admiral H. C. Taylor, U. S. N. 799

NAVAL ADMINISTRATION, III. By Rear-Admiral S. B. Luce, U. S. N.. 809

CORRESPONDENCE. A PERSONAL LETTER. By Captain C. F. Goodrich, U. S. N. 823

WAR AS THE ULTIMATE FORM OF ECONOMIC COMPETITION. By Mr. Brooks Adams 829

AUTOMOBILE TORPEDOES; THEIR USE AND PROBABLE EFFECTIVENESS. By Lieutenant Lloyd H. Chandler, U. S. N. 883

Discussion:

Captain F. J. Drake, U. S. N., 906.—Commander Murdock, U. S. N., 909.—Commander E. B. Barry, U. S. N., 910.—Commander Bradley A. Fiske, U. S. N., 911.—Lieutenant-Commander W. Irving Chambers, U. S. N., 912.—Lieutenant-Commander Roy C. Smith, U. S. N., 913.—Lieutenant E. E. Capehart, U. S. N., 914.—Lieutenant W. C. Davison, U. S. N., 915.

HISTORICAL INSTANCES OF SCOUTING. By Captain C. F. Goodrich, U. S. N. 917

NATHANIEL BOWDITCH. By Lieutenant G. W. Logan, U. S. N. 927

WAR SIGNALS. By Commander Bradley A. Fiske, U. S. N. 931

THE ACCURACY AND PROBABILITY OF GUN-FIRE. By Professor Philip R. Alger 935

THE SUMNER LINE OF GEOGRAPHICAL POSITION AND THE COMPASS ERROR SERVICEABLY DEDUCED BY INSPECTION. By G. W. Littlehales. 953

PROFESSIONAL NOTES. Prepared by Philip R. Alger, U. S. N. 967

Ships of War, Budgets and Personnel.—Steam Trials.—Steam Turbines.—Manœuvres.—Miscellaneous.—The Admiral's Flag.

LIST OF PRIZE ESSAYS 997

OFFICERS OF THE INSTITUTE 1001

SPECIAL NOTICE.—Naval Institute Prize Essay, 1904. 1002

ADVERTISEMENTS.

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THE PROCEEDINGS

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UNITED STATES NAVAL INSTITUTE.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE FLEET.

By REAR-ADMIRAL H. C. TAYLOR, U. S. Navy.

We have happened upon times which are not usual in history. The conditions which surround us, if not unique, are rare. The vast development of our nation during the past forty years, which was hidden from our mental view until the Spanish War disclosed it, has imposed upon us the heavy burdens of responsibility which are inseparable from power, and which Fate never places upon the shoulders of feeble races. In 1898, a duty which had haunted us for many years became plainly apparent. It was to rescue from misery a race of people who were our neighbors and friends. We determined to help them, not dreaming of profit for ourselves; but in this simple act of duty we unconsciously opened tidal gates, through which rushed upon us a flood of powers and duties which must be accepted and fulfilled—or we are not great. It is the test with which Fate tries our capacity for greatness.

It is not a question whether we like the Philippines, or need Porto Rico. They were given into our hands without consulting our wishes or our judgment. The guarding and governing of these distant territories; their improvement and the happiness of their people, is our work whether we like it or not.

It is, however, not alone these areas of land which have added to our burden, but the possession of them lays upon us a further power and responsibility with regard to the ocean which separates us from them, and the shores and seas which lie near them; and upon the navy, therefore, must devolve much of the care of these distant possessions, ensuring their safety, and securing lines of communication between them and the home government.

Congress has provided the ships and guns, but Congress cannot organize a fleet from these materials, nor breathe into it the spirit of discipline, zeal and patriotism without which ships and guns are useless. The people have provided the new navy, believing that the officers and men possess that high quality which will not rest satisfied until the personnel equals the matériel and the fleet is made worthy of its traditions.

Upon us, then, has devolved this most essential work of perfecting our personnel, and we shall lamentably fail if we do not respond promptly and cheerfully to the imperative demands now made upon us.

As wooden ships and sails have passed away, and our shipbuilders have been forced to learn the new methods by which steel hulls are built, armed and engined, so we must realize that changes as great in organization and personnel are needed to prepare the modern fleet for battle and victory.

We are slow to learn this: slow as are all navies in adopting new methods. A military service, whether afloat or ashore, is little more than a mass of traditions, and traditions are stubborn and tenacious.

It is a natural instinct which causes us to dread the rupture of old ways, the changes from old to new forms, the disappearance of established custom, the adoption of the new and untried. This prejudice in the beginning is natural and healthful, and has kept the armies and fleets of vigorous nations in the highest condition of efficiency; but when carried too far it grows hurtful and instills into the body military a subtle narcotic, which, under various forms and names, has ever the essential elements of lethargy and mental indolence.

The armies of Frederick the Great, sinking, after his death, into a rigid formalism, presented an unbroken front of resistance to all change. "What could be better," they said, "than the armies of the Great Frederick?" "How could they be changed without

injury?" This reasoning, true at first, gradually became the cloak to cover that lethargy, which in the short period of one generation paralyzed the very vitals of this once great military body. During the months that followed the battle of Jena the conduct of Prussian troops in presence of their French enemies became notorious throughout the world. There had been warning voices, few but powerful, prophesying destruction if they did not study war and reorganize their military system; but these warnings fell upon unwilling ears and it needed the tragedy of Napoleon's conquest to shake the Prussian army from its apathy and to redeem it through the ways and by the methods of the Steins, Scharnhorsts, the Clausewitz's, and the Moltkes.

With us it is different and, I trust, easier; but we must expect that a century of quiet, broken only by one great war, will have left in our veins a little of that narcotic which is the foe to efficiency. Many of us will instinctively resist the unrest which marks an organization when great changes are occurring in it; we shall mourn the departure of the simple and pleasing life in which our occasional struggles with the elements were quickly succeeded by the quiet of some beautiful harbor and the enjoyment of congenial society. Our pride in the completion of important charts; the mapping of great areas of the ocean; the efficiency of our lighthouses; the work of our Wilkes', Maurys, and other famous exemplars of nautical science, and benefactors of commerce and navigation—all these pleasures and satisfactions we must forego. We will not deny credit due to those duties when there was nothing else to do; but however much we mourn their departure we must not retard it. We cannot for a generation to come, perhaps a century, turn our minds away from our war fleet. Providence seems to have ordained that the world's history for many centuries shall be strongly affected by the efficiency or non-efficiency of the American Navy; by the quality of the weapon which the great republic wields in its imperial path of progress and development.

What can we do to foster that military spirit which is indispensable to the success of our future war fleet? Primarily, I think, by urging at all times action and movement. A fleet is a movable thing; and as action is its vital essence, so inaction, continued too long, is its death. I am speaking to officers of experience who know that some repose is necessary for officers and

crew, but I urge upon them that we abandon the shallow reasoning used to convince ourselves that it is better to lie at anchor than to be underway; better to save the boilers; not wear out the engines; nor overstrain the guns and waste ammunition. We must remember how much our love of ease influences our judgment in these questions, and how easily we find reasons for doing what is comfortable and pleasing.

In emerging from the old period of the navy into the new, we are impressed with the necessity of some directing force for the conduct of the fleet. The want has hitherto been filled by one or more chiefs of bureaus of the Navy Department, under the orders of the Secretary of the Navy. The advice of these able and often eminent officers was formerly sufficient. Our needs were few; our ships were small; a few thousand enlisted men sufficed to man them; the supply of seamen from our merchant service was sufficient; the problems of maintaining a force of forty thousand enlisted men, and training five or six thousand of them at a time had not been foreseen. The ships, although nominally belonging to certain squadrons, each under a flag-officer, were rarely gathered together for long-continued military operations, but dispersed singly to various parts of a station. For such conditions the old system sufficed, and there are officers to-day who believe that we can continue the same system slightly modified and administer successfully a great modern war fleet. I believe this view to be incorrect, and that we must have new methods to suit the present developments of our navy. A comprehensive system must be established, which shall be based primarily upon our war requirements.

What shall the system be? This question was seriously asked ten years ago at the Naval War College. Some officers who were on duty there sought earnestly for its solution. The organization of great commercial companies was examined, and military and naval history searched to find conditions analogous to our own, and to inform ourselves as to methods which had in other countries produced success. The British Board of Admiralty occupied much attention as the directing force of a fleet successful for centuries. The General Staff of the German army offered in its turn much that was useful in these studies. The result emphasized two conclusions: first, the vital importance of keeping the fleet prepared for war; and, second, the necessity of a General

Staff to attain that preparedness. It does not follow that we should have exactly the same organization as the German General Staff; for a system that well fits a monarchy may not be desirable in the navy of a republic; but the German methods, nearer than any other, are what are needed for us, after they have been modified to suit the different political conditions existing in this country.

Shortly after these studies were undertaken the alarm produced by the President's Venezuelan message caused a sudden demand upon the Naval War College for plans of war. These were forthcoming and proved satisfactory to the administration, and the subject was thereby advanced a step further in the notice of the navy. Later, suggestions were made as to the proper form the General Staff should take; of what present offices it should be composed, and what should be its functions. The general belief was that the nucleus of a General Staff could best be formed by combining the Naval War College and the Office of Naval Intelligence under one head, with duties, at first, advisory in their character. Further discussion of these matters were interrupted by the Spanish War. During that period the war plans of the College were occasionally followed, though not always; but there was a distinct consciousness on the part of officers of high rank that there were such things as plans of war, and that they were in many cases useful. Soon after the close of the war the subject again came under discussion and officers who were interested became convinced that all attempts at a better system would fail if the bureau having charge of the personnel of the navy and the distribution of the fleet were omitted from the organization.

It was then—four years ago—that a plan was submitted to the Secretary of the Navy, creating the nucleus of a General Staff by combining the Office of Naval Intelligence and the Naval War College under the direction of the Chief of the Bureau of Navigation, and establishing a board composed of the heads of these bodies and a few other officers of high rank.

This plan found immediate favor with the Department and the President, and with the Admiral of the Navy, who consented to preside over the deliberations of the Board. The Chief of the Bureau of Navigation became chairman of its executive committee.

This nucleus of a General Staff received the name of the " Gen-

eral Board," and has, during the past four years, gone forward in the direction of General Staff methods. Its duty has been primarily to insure the preparation of the fleet for war. It has been miscalled a " Policy Board "; but has on the contrary avoided as much as possible all questions of matériel, and has regarded its proper function to be, not to say what forces we should have, but to prepare for war whatever force Congress should give us.

The Department has sometimes asked the General Board's advice on questions of general policy, but the Board, while considering all questions the Secretary has honored it with, has held to its original purpose, believing that however small our force, if it were ready and the men and officers thoroughly up to their work, defeat when outnumbered could not materially injure the country. If twelve ships of an enemy should overwhelm eight of our own after a vigorous struggle, no discredit would attach to the navy, nor would the prestige of the great republic be seriously impaired; but should twelve of our ships, unprepared in matériel and personnel, be defeated by eight of an enemy, the blow to the nation would never be forgotten.

The principal business of the General Board has been making war plans and perfecting them as time goes on, and thereby training officers to understand them and carry them out. This develops many other collateral lines of duty, which increase largely the work involved. A war plan for a given situation may provide in a few words " That our coast line be protected by a certain naval force, plus the naval militia." This is easy to say, but it involves much work in the stationing of the force and the preparation of detailed orders to insure its supply of stores, coal, ammunition, etc., the choice of bases of operations, and possibly plans for improvised defenses. Underlying all collateral details, the central idea is to make war plans to meet probable conditions in various localities where war is possible during the next few years.

It may be of interest to learn what the later suggestions of the General Board and the Bureau of Navigation, as approved by the Secretary of the Navy, have been, and in what direction they are now leading us.

First, among the larger matters, is the annual mobilization and concentration, which, under the head of " Winter maneuvers," had its first trial last winter. The intention was primarily to practice mobility, to abandon the long-established custom, which tied each

squadron to the limits of a geographical area, and lost sight of its military relations to the squadrons on other stations. Another object was to exercise the squadrons when assembled in passing quickly into a fleet organization, and to teach squadrons and their officers that their ultimate tactical value was in combination with other squadrons, forming a fleet. The results were very satisfactory, not only in the larger features of concentration, but in many details, which had not been foreseen. Increased activity was fostered, not only of ships, but of individual officers and men, leading, among other things, to marked improvement in target practice during the months immediately following the concentration. If, happily, these maneuvers can be repeated annually, we may with reason expect increased efficiency of the whole navy.

The gathering of the battleships into two squadrons has also been productive of good results. Their continuous service in company has produced ease in squadron handling and tactical maneuvers, improvements in all exercises, and healthy rivalry, which have all tended to efficiency and a proper military spirit. The creation of two great fleets, the North Atlantic and the Asiatic, each composed of three squadrons, bids fair, though as yet only begun, to fulfill the requirements of a well-studied scheme of strategy, based upon our probable necessities in peace and war.

The cruising in company of the cruiser squadrons, instead of ships passing singly from port to port has been initiated, and will, I hope, soon become habitual. The destroyers and torpedo boats are being organized in flotillas, and are already attaining considerable proficiency in sailing in close formation.

Such briefly has been the scope of the General Board's work, and with it has been combined effectively, the executive function of the Bureau of Navigation, which under the Secretary's direction, has the duty, so far as its authority extends, of putting into practice the recommendations of the General Board. This combination, so long as it is harmonious, acts very satisfactorily as an informal, incomplete and unauthorized General Staff; its work is much valued by those high in authority; and a disposition is evinced to expand its function and power.

At this point, however, it is found that any further power must come from Congress, and that without legislation this formless though valuable force must remain inchoate and many of its efforts be fruitless of practical result. That the needed legislation

can be obtained is for the present improbable. The additional authority that Congress would confer upon the present combination in expanding it to the proportions of a General Staff, would be opposed by several of the Bureaus of the Navy Department, and by those in public life whose opinions on naval affairs are naturally influenced by them.

Among the powers essential to a General Staff, some of the more important are those of indicating with authority to the Bureaus the supplies for the fleet necessary to its maintenance and efficiency; of deciding the types of ships to be recommended to the Secretary, their speed and armament; the number of reserve guns needed; the number of men and officers needed for the fleet; the amount of coal required to be stored at different points and the choice of those points; the location of future dry-docks. In fact all general questions affecting the fleet's efficiency would be the subject of a General Staff's reports and suggestions to the Secretary of the Navy.

With the Bureaus would still remain, not subject to the General Staff's interference, the manufacturing, purchasing and providing of all materials under their cognizance. The Engineer Bureau would design and construct the engines required to produce the proper speed, but that speed would be named by the General Staff. The Bureau or Office of Personnel would enlist and train the proper number of men, but that number would be named by the General Staff. The Bureau of Equipment would purchase and transport the coal needed to maintain a regular supply at the distant stations, but the stations would be named and the coal needed there would be fixed, subject to the Secretary's approval, by the General Staff.

It will be noted that portions of the authority above mentioned as essential to a General Staff are possessed now by the Bureaus of the Navy Department, and the changes involved would in some degree limit the Bureaus' exercise of authority. It may not be doubted that these powerful influences will be exerted against any such measure, and it is unlikely to succeed unless naval officers generally become convinced that it is indispensable to the highest efficiency of the fleet. The principles of such a system are put briefly before the members of the NAVAL INSTITUTE, in order that they may consider the question in its general aspect. I do not intend to suggest here any detailed measure.

It is my belief that from a General Staff will flow many advantages, and through its methods we shall rapidly move forward towards war efficiency. Such a general directing-body would place at the Secretary's disposition a force by which he could govern and administer the fleet more effectively than the Navy Department heretofore has ever been able to do. His power to direct the fleet, both in war and peace, would be vastly increased, and be on a par with his personal management of the Department itself. In fact, one of the good effects of a General Staff would be to connect the Department directly with the fleet. The Secretary at present commands the Bureaus of the Navy Department directly, but the fleet indirectly, holding many people responsible, but each only in a small degree, for the ships, guns, ammunition, coal, provisions and personnel. Divided responsibility is fatal. A General Staff would answer directly to the Secretary of the Navy for the efficiency of the fleet and its readiness for war. It would have the power, inseparable from responsibility, to direct, under his authority, the measures necessary to ensure that efficiency and readiness.

We may say of the fleet to-day that it has attained to a certain degree of preparedness for war, which is creditable alike to the officers and crews and to the Department that directs its actions. That it can go much further without change in its general administration is to be doubted. It may advance in certain directions and retrograde in others, but further improvement in all qualities, resulting in well-balanced and fully-rounded effectiveness is unlikely without that superior direction, which, under various forms and names, is found essential to all great occupations and enterprises.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL ADMINISTRATION, III.*

By REAR-ADMIRAL S. B. LUCE, U. S. Navy.

Scarcely a generation had passed before the influence upon the country of the war of 1812 began to decline. The idea of complete isolation, and freedom from "entangling alliances" with, what we were pleased to call, the effete monarchies of Europe, took complete possession of the public mind; and war, that relic of a barbarous age, was regarded as impossible with such a remote, enlightened, prosperous and practical people as Americans.

Congress had little use for an army, and much less for a navy; and all plans looking to preparation for war were deemed chimerical. The navy was allowed to die out, practically, and the Navy Department wasted its energies in vain efforts to overcome the apathy or indifference of the legislative branch of the Government.

Our mercantile marine, extending to the most distant shores, whose sails whitened every sea, a source of national pride and of wealth, was already beginning to show signs of that decadence which, a generation later, led to its partial extinction; our carrying trade was gradually but surely passing to foreign bottoms; our naval prestige was on the wane: we were ceasing to be a maritime people.

It was in this state of naval affairs that the opening of the Civil War found us.

*For Naval Administration, I, see *Proceedings U. S. Naval Institute*, Vol. XIV, No. 3, June 6, 1888; Naval Administration, II, Vol. XXVIII, No. 4, Dec., 1902. Written at considerable intervals of time, these papers contain a certain amount of repetition necessary to clearness of statement.—S. B. L.

Our Naval Administration was regarded with such scant respect as to border, at one critical period, on contempt.

At the very outset of the Secession movement, the relief of Fort Sumter was the cause of much anxious thought. Councils were divided. The several members of the Cabinet were comparative strangers to each other; the whole country was in a state of ferment.

The President, after giving the subject much careful consideration, finally decided that it was his duty to make the attempt to succor the beleaguered garrison in Sumter.

Those who do not recall the particulars connected with the proposed relief of Fort Sumter in '61 are reminded that a small force consisting of the Powhatan, Pawnee, Pocahontas and Harriet Lane, under the command of Captain Samuel Mercer, a post captain of the old school, was ordered to rendezvous, on the 5th day of April, 1861, ten miles due east of Charleston Light. The utmost secrecy was maintained in regard to this expedition. The Powhatan had just returned from a cruise and had been put out of commission at the New York Navy Yard. In view of the projected movement, the Navy Department, by an order dated April 1, 1861, directed her to be recommissioned.

On the same day (April 1) the President, without a hint to the Navy Department, telegraphed to the commandant of the New York Navy Yard, directing him to fit out the Powhatan, without delay, adding "she is bound on secret service, and you will under no circumstances, communicate to the Navy Department the fact that she is fitting out." At the same time the President ordered Lieutenant, the late Admiral, D. D. Porter, at that time a comparatively young officer, to the command of the Powhatan, as the successor of Capt. Mercer, and directed him to proceed to Pensacola for the relief of Fort Pickens, thus diverting the heaviest ship, and the senior officer, from the force destined for the relief of Fort Sumter. In addition to this, Captain Samuel Barron, an officer who enjoyed a very high reputation, but who was a southerner, and was believed at the time to hold a commission in the Confederate Navy, was ordered by the President to relieve Captain Stringham as officer of detail. The effect of this order, if carried out, would have been to place a disloyal officer in control of the navy. These orders are of such an exceptional nature that they are given here in full.

[CONFIDENTIAL.]

EXECUTIVE MANSION, April 1, 1861.

To the Secretary of the Navy.

Dear Sir:—You will issue instructions to Captain Pendergast, commanding the home squadron, to remain in observation at Vera Cruz—important complications in our foreign relations rendering the presence of an officer of rank there of great importance.

Captain Stringham will be directed to proceed to Pensacola with all possible dispatch, and assume command of that portion of the home squadron stationed off Pensacola. He will have confidential instructions to cooperate in every way with the commanders of the land forces of the United States in that neighborhood.

The instructions to the army officers, which are strictly confidential, will be communicated to Captain Stringham after he arrives at Pensacola.

Captain Samuel Barron will relieve Captain Stringham in charge of the Bureau of Detail.

(Signed) ABRAHAM LINCOLN.

P. S.—As it is very necessary at this time to have a perfect knowledge of the personnel of the navy, and to be able to detail such officers for special purposes as the exigencies of the service may require, I request that you will instruct Captain Barron to proceed and organize the Bureau of detail in the manner best adapted to meet the wants of the navy, taking cognizance of the discipline of the navy generally, detailing all officers for duty, taking charge of the recruiting of seamen, supervising charges made against officers, and all matters relating to duties which must be best understood by a sea officer. You will please afford Captain Barron any facility for accomplishing this duty, transferring to his department the clerical force heretofore used for the proposed specified. It is to be understood that this officer will act by authority of the Secretary of the Navy, who will exercise such supervision as he may deem necessary.

(Signed) ABRAHAM LINCOLN.

The dire confusion these conflicting orders gave rise to may be better imagined than described.

The parties to the secret of the Fort Pickens relief expedition are believed to have been President Lincoln, Secretary of the State Seward, General Scott, Captain, the late General, M. C. Meigs, and Lieutenant, the late Admiral, Porter.

It is quite true that the existing conditions of the country were altogether exceptional. The times were "out of joint." Washington was full of spies. No man dared trust his neighbor. Ties of family and life-long friendship were in many cases sundered. But making every allowance for a state bordering on chaos, the method of procedure in this case brings out in the

strongest light the utter lack of respect for the Navy Department, as a working organization, in a great national crisis. The military head of the army was naturally in the secret, but there was no military or naval head of the navy; and the civil head, able as he eventually proved to be, was at that time, little known to his colleagues of the Cabinet.

The relief of Fort Sumter, feasible perhaps in the earliest days of the Secession movement, was now deemed impracticable by the highest military and naval authorities. Mr. Seward, who was, from the first, opposed to the measure, had given assurances to the insurgent leaders that it would not be attempted. Mr. Lincoln, on the other hand, decided that it was his imperative duty to make the attempt at all hazards.

On the 28th of March information was received by the administration that it would be impracticable to re-enforce the garrison and that the provisions on hand would be exhausted in about two weeks. The President then declared he would send supplies to the fort; and if the Secessionists forcibly resisted, on them would be the responsibility of initiating hostilities. This conclusion, though it conflicted in some degree with the views of the military authorities, the President felt to be a political necessity. He could not, he said, consistently, with his convictions of his duty, order the evacuation of Sumter; and it would be inhuman on his part to permit the heroic garrison to be starved into surrender, without an attempt to relieve it.

The Secretary of State did not concur in these views and argued against the measure. The President had fully decided on his course, however, and the next day, March 29th, issued the necessary orders.

As the expedition was of a military character, the Secretary of War commissioned Mr. G. V. Fox, then a private citizen, to command the expedition, and gave him his written instructions.

But Mr. Seward persisted in his opposition to the President and the rest of the Cabinet; and as he had given assurances to the southern leaders that Sumter would be evacuated by the Federal forces, he now proceeded to make good his word by rendering abortive the plans of the President. To accomplish this he actually usurped the authority of the War Department and the Department of the Navy, calling to his assistance Captain Meigs, of the army, and Lieutenant Porter, of the navy. The

result of their joint effort was the drawing up, for the President's signature, of the confidential order already given, and the sending of the telegraphic dispatches diverting the Powhatan and the senior officer from the Sumter expedition. The failure of the Sumter expedition was thenceforth a foregone conclusion.

On receipt of the extraordinary order which practically placed a Secessionist officer in control of the navy, Mr. Secretary Welles at once appealed to the President, who promptly disavowed the order. "Mr. Seward," he said, "had been there with two young officers. One was Captain Meigs, another was a companion, a naval officer named Porter. Mr. Seward had these young men here as clerks to write down his plans and orders." *

On matters being explained, the President frankly acknowledged that the paper "was an improper one, and must be regarded as cancelled; that he had signed it without due consideration; and that such a thing should not occur again." And it never did to the end of his administration.

On the same day of the promulgation of the orders referred to, namely, April 1st, the President received from the Secretary of State a memorandum entitled "Some Thoughts for the President's Consideration. April 1st, 1861."

The gist of this very remarkable paper, as given by Mr. John G. Nicolay in "A Short Life of Lincoln," is as follows: "After a month's trial, you, Mr. Lincoln, are a failure as President. The country is in desperate straits and must apply a desperate remedy. That remedy is to submerge the South Carolina insurrection in a continental war. We must declare war against France and Spain. Some new man must take the executive helm and wield the undivided Presidential authority. I should have been nominated in Chicago and elected in November, but even now am willing to take your place and perform your duties."

In this "incident of phenomenal strangeness," as Mr. Nicolay terms it, we have the key of this "comedy of errors."

"Mr. Lincoln's unselfish magnanimity is the central marvel in the whole affair," adds Mr. Nicolay. His answer to Mr. Sew-

*Gideon Wells in *The Galaxy*.

ard's memorandum ended the argument, and the incident was closed, never again to be alluded to during Mr. Lincoln's life. There was, thenceforth, no doubt as to who was master.

From the attitude assumed by one so high in authority as the Secretary of State, second only to that of the President himself, we cease to wonder how a high-spirited young officer as Lieutenant Porter then was, should, when sent for and consulted by Mr. Seward, readily fall into any plan which promised active service and a chance for distinction and promotion.

The episode was a painful one to all concerned. It is very creditable to Mr. Seward, that he at once realized, and frankly acknowledged his mistake in interfering with matters that did not pertain to his office. He soon came to see the true character of Mr. Lincoln, whose measure he had, up to that time, failed to take.

Explanations made and accepted by those concerned, the Navy Department resumed the full control of its own affairs.

Knowing Admiral Porter as I did, knowing how amenable he was to law and regulations, I am fully persuaded that, had there been a Board of Navy Commissioners attached to the Secretary's office, he would not have placed himself under the orders of the Secretary of State. Mr. Gideon Welles, with his patriarchal appearance and gentle manners, did not at that time appeal to the average naval officer with any great degree of force.

Had such a one as Commodore John Rodgers, the first President of the Board of Navy Commissioners, been in office, or Charles Morris, or one of their successors, who would have brought down, had the office continued, the traditions of the service, Lieutenant Porter would not have ventured to set his authority at defiance. Indeed, it is more than doubtful if Mr. Seward himself would have done so.

Such is the danger of amiability in the exercise of military authority. It invites insubordination.

It may be mentioned in passing that Fort Jefferson, on the Dry Tortugas, and Fort Taylor, at Key West, were saved to the Union cause, not by the Navy Department, but through the instrumentality of Commander, the late Rear-Admiral, Thornton A. Jenkins, and Captain, the late General, "Baldy" Smith, both officers being at that time members of the Light House Board.

Let us now turn to the Port Royal expedition, and subsequent events off Charleston, S. C., and note the workings of our system of naval administration.

It is scarcely necessary to premise that, for the individual members of the naval administration of that day, I have always entertained the most profound respect. It is the system, only, to which reference is made. The individuals themselves, composing the naval administration, were gentlemen of exceptional ability. That fact, indeed, makes the case against the system all the stronger.

In a former paper (Naval Administration, II)* was mentioned the Advisory Board, known as the Committee of Conference. It was composed of Captain S. F. DuPont, Chairman; Major J. G. Barnard, U. S. Engineers, the military member; Prof. A. D. Bache, Superintendent of the U. S. Coast Survey, the civil member; and Commander, the late Rear-Admiral, C. H. Davis, junior member and Secretary.

The province of the head of the Coast Survey was to furnish the topographical and hydrographical information necessary to the formation of plans of naval operations. These plans were very comprehensive. They embraced the whole of the Atlantic and Gulf coasts, including the Mississippi river; contemplating not only such operations as were necessary to make the blockade effective, but also operations of a purely military character.†

From this it will be seen that the Committee of Conference was of the nature of what we came to know later as a Strategy Board. Its labors were of great service in enabling the Department to take prompt measures for the occupation of portions of the southern coast. The capture of the forts at Hatteras Inlet was the first fruit of its labors. This was followed by the capture of Port Royal.

The Committee of Conference was born of the necessity of the times, and to supply a radical defect in our naval organization. When that committee was broken up, as it soon was, by the assignment of its members to other duties, there was no one left upon whom the duty could devolve, of directing naval operations. The outline of a naval campaign had been mapped out

* *Proceedings of the U. S. Naval Institute*, Vol. XXVIII.

† Life of Charles Henry Davis, Rear-Admiral, by his son, Captain Charles H. Davis, U. S. N.

for the Department, as already explained; and the machinery set in motion. But such was the vast amount of labor imposed by the war, and the political conditions of the country, upon the exceptionally capable head of the Department, and his very able assistant, that they had not the time, amid their constant and exacting duties, to give to the study of some of the war problems presented for their considerations, and there was no office to repeat it once more, no Strategy Board, no General Staff, to which the Secretary of the Navy could submit such questions.

The choice of objective is one of the determining factors in war. In the present case this choice was left to Admiral DuPont, who, "after mature deliberation,"* selected Port Royal, as the objective of the fleet under his command.

It may be readily conceded that, under certain conditions, the choice of objective should be left to the officer responsible for the success of the campaign. Here, then, we may, without disparagement to the Navy Department, give Admiral DuPont the entire credit for a wise choice.

But subsequent operation (mainly in regard to Charleston) demonstrated, in a marked degree, the necessity of a Strategy Board, or, as we prefer now to call it, a General Staff, the members of which, unhampered by executive, or administrative duties, or the distractions inseparable from a quasi civil office, could give their whole time and attention to the military questions incident to the campaign in progress, for the benefit of the Secretary of the Navy.

There were reasons, mostly sentimental, why it was desirable that Charleston should be captured. But, from a military point of view, the reduction and occupation of that city was not of sufficient importance to warrant a serious attempt in that direction. The government's policy was to keep only just enough troops in and about that district to occupy the attention of the Confederate authorities and prevent them from sending the troops for the defense of Charleston, to re-enforce the army under Lee.

But the Navy Department was not satisfied with this passive policy. It wanted a more aggressive course. It wanted Admiral DuPont to capture Charleston with his iron-clads, the monitors, under his command.

* Report of Flag Officer DuPont. Rebellion Records, Vol. 12, page 158.

"There is no place that the American people would so delight to see captured as Charleston," wrote the Secretary of the Navy to Admiral DuPont, under date of June 5, 1862.

This opinion, well grounded no doubt, coupled with the fact that the confidence of the Assistant Secretary, Mr. Fox, in the monitor class of vessels was so profound as to lead him to say that "One monitor alone would cause the immediate evacuation of Charleston," forces upon one the conviction that, as a purely military question, the situation at Charleston was not understood by the Department.

On the 27th of September, 1862, Admiral DuPont left his station under orders for Washington whither he was summoned for the purpose of conference.

He returned to his command October 21. About six months later, or on April 7, 1863, Admiral DuPont with nine ironclads made a determined attack on the forts commanding the entrance to Charleston harbor.

He met with a decided repulse. In his report of the action to the Department the Admiral wrote, "I determined not to renew the attack, for in my judgment it would have converted a failure into a disaster. I will only add that Charleston cannot be taken by a purely naval attack, and the army could give me no co-operation."

This wholly unlooked for result was a great disappointment to the Navy Department and gave rise to correspondence with Admiral DuPont in which both sides exhibited some little feeling.

The Admiral in his letter of June 3, 1863, wrote to the Department, "When I left Washington (referring to his visit in October, '62), there was really nothing matured, though I was firmly impressed with the fixed determination of the Department that Charleston should be attacked; and that, with the ironclads, the attack must be successful."

Again, after alluding to the defects of the monitors, especially to their want of offensive powers, Admiral DuPont adds, "these facts, however, seemed not to have changed the views of the Department, and, in accordance with its previous orders and its well known determination to effect the capture of Charleston, I determined to make the experiment, and to risk, and possibly to lose, whatever prestige pertained to a long and successful professional career, in order to meet the necessities

of war and the wishes of the Department." He might have omitted the "necessities of war."

The Admiral felt that he was the victim of a false conception of the situation of Charleston, by the Department; and that his professional reputation was to be sacrificed to a defective system of naval administration. There was no staff attached to the Secretary's office to prevent placing Admiral DuPont and his command in the utterly false position of being called upon to solve an insoluble problem, viz.: the capture of Charleston without adequate co-operation by the army.

The failure of the attack of the monitors on the forts did not make much impression on the Navy Department.

Admiral Dahlgren, immediately on his arrival as the successor of Admiral DuPont, July 4, 1863, took up the same hopeless task.

A year had elapsed since the failure of the attack of the nine ironclads, when, on the 10th of May, 1864, Admiral Dahlgren called together the commanding officers of the Ironsides and the monitors to discuss the question of attacking Fort Sumter. I was one of those summoned, being then in command of the monitor Nantucket.

Those present were Commodore S. C. Rowan, commanding the New Ironsides; Commanders George H. Cooper, commanding monitor Sangamon; Napoleon B. Harrison, the Catskill; Lieutenant-Commander Edward Simpson, the Passaic; Lieutenant-Commander S. B. Luce, the Nantucket; Lieutenant-Commander Wm. Gibson, the Lehigh; Lieutenant-Commander John L. Davis, the Montauk; Lieutenant-Commander L. C. Miller, temporarily in command of Nahant, and Lieutenant-Commander Joseph M. Bradford, aid to Admiral Dahlgren. The question was as to the advisability of attacking Sumter "Seriously, in order to lessen its offensive and defensive power, etc., etc.,"

Lieutenant-Commanders Bradford, Simpson, Gibson and I voted for attacking.

Commodore Rowan, also, with certain qualifications; the others were strongly opposed to attacking.

May 12, another meeting of monitor captains was called. A full discussion took place. The question had been carefully thought over and discussed among ourselves since the first meeting, and was now thoroughly threshed out with the result

of a modification of views on the part of some of those present. I, for one, saw reason for changing my opinion. When the question was put once more: "Is it advisable to attack Sumter and reduce its powers offensive and defensive, with the present force of seven monitors and the Ironsides, having reference to all questions involved?" the vote stood—No: S. C. Rowan, Captain Joseph Green (who was to have the Nahant), George H. Cooper, Harrison (Napoleon B.), Gibson, Luce, Davis (seven). Yes: Simpson, Bradford (two).

While operations of some sort seemed advisable, the object to be gained by attacking Sumter was not quite clear. To me, individually, we were groping in the dark; and the other members of the council impressed me as being in pretty much the same state of mental obscurity. There was no one present who seemed to understand the problem to be solved, and able to state it in concise terms. The well-known views of the Navy Department, moreover, only served to complicate the question.

The line of attack on Charleston was, according to our military authorities, by way of James Island. But as it required a force of about 40,000 men, the attempt was not approved of in Washington.

Charleston was considered a minor objective, and the troops could not be spared from the more important operations elsewhere. A military force was maintained there, by us, barely sufficient to occupy the attention of the Confederate authorities and prevent them from sending troops from South Carolina to re-enforce Lee in Virginia, as already stated.

Under existing conditions the navy could not look to the army for adequate co-operation. The question, then, resolved itself into the simple one of taking Charleston by the monitors alone.

The Navy Department, as has been shown, thought this could be done. The Monitor and Merrimac fight had given an exaggerated idea of the military value of that class of vessels. And the capture of Port Royal, by the fleet under Admiral DuPont, had blinded the Department as to the conditions at Charleston. The two cases were entirely dissimilar. Here was the Department's mistake.

To resume: From the Nantucket I was transferred to the command of the Pontiac, and on the 5th of January, 1865, was ordered to report to General Sherman, then in Savannah, for duty in Savannah river in connection with the army.

On reporting at headquarters, General Sherman indicated in a few, short, pithy sentences, and by the aid of a map, his plan of campaign from Savannah to the north. General Slocum, commanding the left wing of the army, was to move up to Sisters' Ferry, about forty miles above the city, and cross the Savannah river by means of a pontoon bridge into South Carolina. The object in having a gunboat (the Pontiac) was that it might go up the river above the ferry in order to protect the pontoon bridge from molestation by the Confederates supposed to be in force somewhere in the direction of Augusta. "When I get on solid ground," he said (for much of that part of the country was inundated), "somebody will have to get out of the way!" And he added, in the pleasant style of banter, with which he was accustomed to talk to naval officers: "You navy fellows have been hammering away at Charleston for the past three years. But just wait till I get into South Carolina; I will cut her communications and Charleston will fall into your hands like a ripe pear." And that is just what actually came to pass.

After hearing General Sherman's clear exposition of the military situation the scales seemed to fall from my eyes. "Here," I said to myself, "is a soldier who knows his business!" It dawned upon me that there were certain fundamental principles underlying military operations which it were well to look into; principles of general application whether the operations were conducted on land or at sea.

Leaving Pocataligo, his army now well in hand, General Sherman marched on Columbia and captured the city with little difficulty. This led to the immediate evacuation of Charleston, February 17, 1865, or a little over three years after capture of Port Royal.

A few weeks later I accompanied Admiral Dahlgren, by invitation, in a ramble about the deserted streets of Charleston. On the 14th of April, I was in Fort Sumter and witnessed the hoisting of the flag by General Anderson, and heard the oration delivered on that occasion by the Rev. Henry Ward Beecher. Charleston and the forts were ours at last; but not through the efforts of the monitors.

Charleston fell into our hands just as General Sherman said it would, by severing her communications.

There was, then, I learned, such a thing as a military problem; and there was a way of solving it; or, what is equally important, a way of determining whether, or not, it was susceptible of solution.

In the case of the reduction of Charleston, it appeared that there were three methods proposed:

1st. General Sherman's plan, which was eminently successful.

2nd. The movement by way of James Island, and the co-operation of the land and naval forces. This was entirely practicable with adequate support of troops; and

3rd. The Navy Department's plan, or, to be more exact, the Navy Department's view, which was to capture Charleston by the monitors alone, without the co-operation of the army. This was wholly impracticable.

The lessons to be drawn from this experience are that the Secretary of the Navy should have, if only in justice to himself, a staff of naval experts to lean upon; that this staff should be attached to, and made part of, his office, and be under his immediate supervision; and that the members of this staff should be prepared for staff duty by a special course of study.

In other words, the Civil War demonstrated conclusively the necessity of a War College and of a General Staff. We have the one; let us now have the other without more ado.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CORRESPONDENCE.

A PERSONAL LETTER

REGARDING THE DUTY WHICH WE ALL OWE OF HELPING TO KEEP ALIVE AND OF TRANSMITTING TO FUTURE GENERATIONS THE BODY OF STORIES AND TRADITIONS WHICH ILLUSTRATES THE MANNERS AND CUSTOMS OF THE NAVAL SERVICE.

Introductory Note.

The following letter, having been brought to the attention of the Board of Control of the Institute, is published, with the author's consent, in the hope that it will so appeal to members of the Institute and others interested in the navy as to cause them to give personal support to the project which it advocates.

The Board of Control is in full sympathy with the views expressed in Captain Goodrich's letter, and will do all in its power towards establishing and maintaining a file of records of adventures, incidents, travels and stories bearing on naval life and naval personalities, from which selected portions will be published from time to time in the Institute Proceedings, and to which reference may be had by anyone properly interested.

It is hoped that the efforts of the Institute in this direction will meet with the support and co-operation necessary to their success.

Philip R. Alger, Professor, U. S. Navy,
Secretary and Treasurer.

U. S. NAVY YARD, PORTSMOUTH, N. H., October 14, 1903.

My Dear Brownson:—If, in your judgment, the subject of this communication merits consideration, I beg that you assume the heavy responsibility of foster-parent, give the scheme that vitality which your position and interest alone can supply and, laying my letter before the Council of the Naval Institute, urge that its underlying idea be adopted as the basis of a continued policy for the preservation and publication of many interesting records of a navy which is fast becoming but a vague tradition.

Specifically, I venture to suggest that a department of "Annals and Episodes," of "Records and Reminiscence," or whatever other title may be thought advisable, be established in the Institute's PROCEEDINGS to which all officers, old and young, are invited to contribute anything and everything in the way of biographical or autobiographical notes, accounts of expeditions, walking trips, hunting excursions in remote corners of the world, extraordinary experiences in storms at sea, episodes of war time (especially during the Mexican and Civil Wars), landing parties and cutting-out parties, encounters with savages and with unfriendly civilized foreigners, tales of the old duelling times, occurrences illustrating the life and esprit of the old navy, and above all, yarns—yarns humorous, yarns tragic, yarns descriptive, yarns personal.

Two years ago I endeavored to establish a Navy Records Society to garner some of this precious material, but I have only succeeded in eliciting that mild approval which is given so freely from the easy chair of languid acquiescence. Of pulling off the coat to help on the good work, and of diving down into the pocket to contribute to the cause, I confess I have, as yet, seen and heard nothing, so that I have been forced to conclude that some other method must be devised or the whole scheme abandoned. To the latter, I cannot reconcile myself. If we are indeed the naval sons of our naval fathers, it is incumbent on us to obey the fifth commandment, to do honor to those who have, by labor and example, made the navy so fine a heritage for us who follow after and to erect a permanent monument of history and tradition to their memory.

After all, what is better or more suited to the purpose than the PROCEEDINGS of the Institute? In my despair these have assumed

the form of that typical last resource. To them I turn with fresh hope.

When, for example, I reflect that Rear Admiral Charles H. Baldwin has but recently passed away, carrying with him priceless souvenirs of the Mexican War, in which he commanded a battery of what he was pleased to call "flying artillery"—small guns mounted on ox carts and firing shot made of solid copper—I realize how negligent somebody (possibly myself) has been, and that it is high time to inaugurate a reform, to make a start, however inadequate. Even the very language of the sea is being forgotten, and he who uses it to-day is looked upon as an archaic survival of a bygone age; yet the seaman's vernacular is the medium of expression for all that is characteristic or unusual in his existence and is, indeed, his very breath of life.

My dear friend and former Captain, Rear-Admiral Gherardi,* is still with us, to tell, if he will, of personally carrying Walker, the filibuster, from Nicaragua to New York; of the message from Captain Ingraham which Gherardi himself delivered in Smyrna, July 2, 1853, to the captain of the Austrian brig *Hussar* demanding and securing the release of Martin Kostza, an incident which startled every court in Europe.

Or again, Rear-Admiral J. J. Read knows a story of thrilling interest, the destruction of the British gunboat *Bulldog* in the harbor of Cape Haytien, in which his own part, though slight, was more than creditable.

There are people still living who have heard of the peace-loving Turner and how, after avoiding a quarrel with the mess bully for over two years, he finally shot and killed him.

It is unnecessary to multiply examples—there is not an officer in the navy who does not amuse or edify his friends at home by at least one sailor's yarn. Nine chances out of ten that yarn illustrates an old navy custom, or tradition, or expression; while it is certain to exhibit the man-of-war's man of our youth in some act of farce or tragedy, or some play of his virtues, his vices and his weaknesses, which makes him laughable, or admirable, or even objectionable, but never uninteresting. Such stories, and others relating to the generation of officers and sailors now passing away should not be lost—it is the duty of every member of

*It is with infinite regret that I learn, since penning these lines, that he too has joined the great majority.

the naval profession to contribute his mite. Given a repository upon which the whole service may draw both for pleasure and profit, it will become impossible longer to shirk this duty. Our pride and self-respect will force us to put into this store as much as we take out, and so keep the balance good.

A word or two as to the practical side of this proposition. From some of the older officers it will be idle to expect the drudgery of the recalcitrant goose quill. A persuasive agent, acting as host, a satisfying dinner, a congenial companion or two, and a stenographer concealed behind a screen may at times be necessary. But can any one doubt that the investment will pay? I am confident that the increased circulation of the Institute's PROCEEDINGS will render a speedy answer, in the affirmative, to this question.

But it is not for me to enter into the details of the scheme proposed. They should be left to the wisdom of the Council and to the younger and more vigorous hands which it controls. I shall have done everything in my power in asking a hearing for the project and in promising to help those to whom the Council confides the laboring oar.

* * * * * *

The foregoing has been long scribbled on loose sheets of paper awaiting a favorable opportunity for putting them into legible shape while the idea itself had, for a still longer time, been working in my mind, striving after proper expression, when Captain "Jack" Barnes' most interesting, valuable and instructive article in the last number of the PROCEEDINGS appeared and freely offered the key to the whole difficulty. The possibilities which he holds out are fraught with the greatest advantages to the service, to the Naval Academy and to the Naval Institute. It seems self-evident that there can be no home for Captain Barnes' priceless records other than the *Naval Institute, at the Naval Academy, and under the same roof with the Academy Library.* Here may his great history of the American Navy and his naval memorabilia find an appropriate refuge under the charge of a careful and expert custodian; here will they be accessible to all who desire to consult them; and here, too, would the random contributions, which we all, I am sure, would gladly see pouring in from every side, range themselves in order under the shadow of Captain Barnes' splendid

monument of a lifetime's interest and activity. This done, our Naval Institute would be to us what the Royal United Service Institution is to the British Navy, a museum of naval history, naval trophies and naval art, the fitting repository of story and tradition, a gallery of portraits, in short the very center of the navy's intellectual life; while through its PROCEEDINGS, giving in each issue a skilfully edited instalment of record and of reminiscence, it would speak to those far away and scatter abroad with wise and liberal hand the inestimable benefits of Captain Barnes' welcome gift and of the contributions by others stimulated to helpfulness by his example.

Am I too sanguine in hoping that the Superintendent of the Naval Academy and the Council of the Institute will seize the wonderful opportunity which the building of a new library affords and promptly say to Captain Barnes that in a humble way the navy expects to follow where he has led, that the "final resting place" of his unexampled collections which he desired is not far to seek, that it has, indeed, been already discovered and that it will shortly be ready for their reception?

Faithfully yours,

C. F. GOODRICH.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WAR AS THE ULTIMATE FORM OF ECONOMIC COMPETITION.*

Gentlemen:—I apprehend that, if we would essay to forecast the future, we must first turn to the past, and try to unravel the sequences of cause and effect which have created the present. Then, assuming that the same forces continue in operation, we may draw our inferences concerning coming events, always with the reservation that our conclusions must be more or less inaccurate, since with finite minds and limited knowledge we undertake to deal with the infinite.

At the outset we must establish a starting point. Last year when I had the honor to address the War College, I advanced the proposition that the chief motor of human action is the instinct of self-preservation, and that in the struggle for life, men follow the lines of least resistance. I have seen no reason to change this view. My next deduction was that, since few communities have ever been self-sufficing, men from the onset have been constrained to supply their necessities from without, either by purchase or by force, and that, to trade or rob, they have been obliged to travel. In travelling animals follow the easiest paths, which we call roads, and where roads have converged men have met and markets have grown up. Other things being equal, those markets have thriven best which have been safest and most accessible, and accordingly competition has led, from the remotest antiquity, to the development in market towns of some mechanism for caring for roads, for building and guarding walls, and for the maintenance of tribunals to decide disputes. Such a

*Two papers read by Mr. Brooks Adams before the War College on July 30, 31, 1903.

mechanism is, however, the embryo of a civil administration, and it is the presence of a civil administration which makes a capital city.

As energy gathers volume, highways stretch across continents, and the states which they traverse acquire a common interest in defending the traffic which feeds their markets and supports their population. Thus, economic systems are generated comprising several states, and when two or more such systems connect the same termini, war is apt to follow, for war is the sharpest form of economic competition.

Until very recently the two greatest economic systems which had ever existed were those which, having their bases in eastern Asia, had their terminus in North America, and their central markets in Europe. Of these, that which had London for its focus became predominant after Trafalgar and Waterloo, but previously war had raged between the two systems for upwards of a century, and I conceive that our country became moulded into the shape in which we know it through the struggle between these antagonists.

In this long conflict, the prize at stake in the western hemisphere was the valley of the Mississippi which is now, and must long continue to be, the reservoir toward which the streams of traffic flow. Had either England or France stood alone, the United States could hardly have achieved independence, but would, apparently, have remained an appendage to an external seat of empire. Lying between the two combatants, the English population scattered along the Atlantic coast first acquired some degree of cohesion, and then, stretching out westward, gradually assumed the proportions of the greatest consolidated social mass which has, possibly, ever existed.

Centralization is at once a cause and an effect of the convergence of highways, and as the paths of least resistance are determined by the physical character of each country, the problem of centralization can only be approached through geography.

Before the invention of railways, water-courses offered less resistance than roads, and therefore rivers and canals were the favored channels of communication. The heart of the North American continent is traversed in all directions by the Mississippi and its tributaries, but for our purposes we may confine our attention to that portion of this region which is bounded by the main stream

of the Mississippi and the Wisconsin, together forming an avenue north and south from Lake Michigan; and by the Ohio, the Alleghany and French Creek which, toward the north, are divided from Lake Erie by an easy portage. These rivers represent the legs of a vast triangle, having Lakes Erie, Huron and Michigan for a base. This triangle, in the seventeenth century, could be best entered from Europe by way of the Saint Lawrence and Lake Ontario, or the Ottawa and Lake Huron; but whichever route was chosen, access to the interior could be closed by the power which held the Niagara River, Detroit and Mackinaw.

Supposing Canada and the Niagara River to be in the same hands, French Creek could be reached from Presque Isle, where Erie now stands, and once French Creek were gained the way lay open to Pittsburg. But whoever controlled the Alleghany to Pittsburg controlled the Ohio, and shut up the inhabitants beyond the mountains within the narrow strip which stretches from the crest of the Alleghanies to the sea. Nor was this the only advantage which fell to him who held the three keys to the Lakes. At the opposite end of Lake Erie, the Indian trail lay past Toledo up the Maumee to the Wabash, while by Green Bay and Fox River canoes could be carried to the Wisconsin, and from the Chicago to the Illinois.

The French very early grasped the geographical problem. In 1608 Champlain founded Quebec, and somewhat later Marquette and La Salle penetrated the depths of the wilderness. By 1750 the forces of Louis XV held the Saint Lawrence, the Niagara, the Ottawa, Detroit and the Maumee, Green Bay and Chicago. The French settled New Orleans in 1718.

Thus the French lay on the flank and rear of the English who had occupied the coast, and who were shut off from the west by a range of mountains whose outlets were held by the enemy. The only egress across easy country led by the Mohawk to Oswego, but the possession of Oswego availed little without Niagara.

Therefore the two rival economic systems, whose central markets were at London and Paris, and whose bases rested on the Pacific and the Indian Oceans, were brought into a predestined conflict for the only region which could serve as a terminus for the commerce flowing from China westward. As was inevitable also, the conflict broke out at the point where the main highways

of the two systems converged. That is to say, at the junction of the Alleghany and the Monongahela.

The French starting from Quebec passed Niagara and descended the Alleghany to Pittsburg. The English leaving the Chesapeake ascended the Potomac to Cumberland and thence descended the valley of the nearest water-course to the Ohio.

Thus Virginia, being the base whence the lines of communication of the enemy could be best attacked, became the seat of English activity, and accordingly the energy of the American people found its most perfect expression in George Washington, a native of Virginia.

Gentlemen, I need not speak to you of Washington's mission to Duquesne, or of his first campaign and of its ending at Fort Necessity. You know better than I the story of the Seven Years War, of Braddock, of Louisburg and of Quebec. My province is confined to pointing out the influence which that struggle has had in moulding American civilization, and its possible bearing on the future. The incarnation of the war was George Washington, for he represented most perfectly the principle of American consolidation, and he fired the first shot in the struggle which, beginning at Great Meadows, ended only at Yorktown. The direct effect of that struggle was the adoption of the constitution of the United States, and it was due to Washington, more than to any other man, that that decisive step toward American centralization was taken.

I conceive that the Seven Years War and the War of the Revolution were parts of a whole. They cannot be dissociated. The victory of Great Britain in the first, determined the outbreak of the second. We can no longer rest content to attribute the policy of colonial taxation adopted by Parliament at the opening of the reign of George III, to the caprice of a minister or the perversity of a king. Nothing is accidental, and the advance of any nation is the resultant of forces. The moment the French were expelled from the valley of the Mississippi and this new region was thrown open to English emigration, American consolidation became inevitable. American consolidation necessitated a more complex administrative system, a larger outlay, and augmented taxes. The only point in doubt was whether the new empire in the West should exist as an appendage to the system centered in London, or whether it should be divided from the parent stem, and form the nucleus of a new organism.

Even before the treaty of Paris in 1763, which ended the Seven Years War, decentralization in America had broken down. You know how the scattered colonies had attempted concerted operations against the French and how lamentably they had failed. You know the waste of life and treasure entailed by incompetence, that the royal governors agreed in reporting the situation as intolerable, and that as early as 1754 Franklin advocated readjustment. No soldier suffered more from administrative imbecility than Washington, and when Pitt decided on assaulting the enemy's citadels he found himself driven to rely on English troops. Conditions did not improve with the advent of peace, for with peace fresh complications gathered. The terminus of the great international trade-route had indeed been conquered, and emigrants were swarming over the mountains, but the settlements on the Kentucky and the Ohio could only be reached from the Atlantic Colonies by roads crossing New York, Pennsylvania or Virginia. Forthwith it became apparent that if the core of the continent were to consolidate with these eastern communities it must be because access to the ocean was easier by paths leading through them than by the Mississippi, the Ottawa or the Saint Lawrence. Washington appreciated the situation and early pointed out the necessity for improved communication, since, as he observed, "the motives which predominate most in human affairs, are self-love and self-interest." No one doubted that roads could be built across New York to Niagara, or over the Virginian mountains, but for such roads to be serviceable, a central administration must have jurisdiction capable of enforcing order, and maintaining equal commercial rights. Washington stated the proposition with precision. He even went so far as to oppose efforts to open the Mississippi before the East had completed its highways, lest by so doing the country should be split in twain. In 1785 he wrote to Lee; "However singular the opinion may be, I cannot divest myself of it, that the navigation of the Mississippi, at this time, ought to be no object with us. On the contrary, until we have a little time allowed to open and make easy the ways between the Atlantic States and the western territory, the obstructions had better remain. There is nothing which binds one country or one State to another but interest." *

* Writings of Washington, Sparks, ix, 119.

The year before he had explained fully to Governor Harris of Virginia, in a striking letter from which I can quote but a single paragraph, that, "The western States (I speak now from my own observation) stand as it were upon a pivot. The touch of a feather would turn them any way. They have looked down the Mississippi, * * * and they looked that way for no other reason, than because they could glide gently down the stream; * * * and because they have no other means of coming to us but by long land transportations and unimproved roads." "But smooth the road, and make the way easy for them, and then see * * * how amply we shall be compensated for any trouble and expense we may encounter to effect it." * Afterward, in a letter to Lafayette he observed, in speaking of his scheme of the Potomac Canal, "This * * * will bring the Atlantic States and the Western Territory into close connection, and be productive of very extensive commercial and political consequences; the last of which gave the spur to my exertions, as I could foresee many, and great mischiefs which would naturally result from a separation—and that a separation would inevitably take place, if the obstructions between the two countries remained, and the navigation of the Mississippi should be made free."† Doubtless both Grenville and Townsend acted largely from instinct. Certainly Englishmen in 1763 had not thought out the American problem as accurately as had Washington twenty years later, yet none the less they obeyed a resistless impulsion when they attempted to effect the consolidation of the United States from London. Between conflicting forces a resultant must be obtained, and in this case the process reached the point where friction kindled war. On the one side lay the diverging interests of different sections of the same economic system; on the other the antagonism between two systems which were already in active competition.

The central market or capital, being the stronger, will always prey upon the provinces, and as the British Islands had been stronger than the American colonies, they had persistently used them for selfish ends. They had monopolized American trade to enrich English merchants and they had suppressed American manufactures in order to force Americans to buy English wares.

* Sparks, ix, 63.

† Washington to Lafayette, 1785, Writings of Washington, Ford, 10, 47.

By the Navigation Acts, Parliament shut out foreign shipping from the colonies; and the legislation regarding iron, aptly illustrates the policy adopted toward colonial industry. Then, as now, Great Britain could not supply pig iron enough for her wants; therefore, she encouraged the export of pig iron from the provinces where charcoal was plenty; but I quote a passage from Adam Smith to show how rigidly she limited colonial industry to the production of the raw material and resisted competition in the sale of finished products: "While Great Britain encourages in America the manufactures of pig and bar iron, * * * she imposes an absolute prohibition upon the erection of steel furnaces, * * * in any of her American plantations. She would not suffer her colonists to work in those more refined manufactures even for their own consumption; but insists upon their purchasing of her merchants and manufacturers all goods of this kind which they have occasion for." *

While French armies threatened their frontiers the inhabitants of the Atlantic coast had no alternative but to pay these indirect imposts as the price of safety, and, by so doing, they probably made a good bargain. They could hardly have protected themselves so well or so cheaply. When, however, the French were expelled from Canada, these conditions changed. The Mississippi valley lay open, and a new empire must grow up beyond the mountains; but, as between Americans and Europeans, it remained to be determined whether this new empire should be administered by natives from a native capital, or by Englishmen from London. Obviously, it was more to the advantage of Americans to regulate their own exchanges as best they could and do their own administration, than to have their exchanges adjusted for the benefit of Englishmen, and at the same time pay Englishmen for doing the work.

Conversely, the British perceived in American revolt an attack on their supremacy; for, should America become industrially and commercially independent, she could hardly fail to develop into the seat of a new economic system, which would cause the disintegration of the old. Nor in so judging did they err. It is true that the difficulty of establishing cheap transportation in the west-

* Wealth of Nations, Book iv, vol. 2, chap. vii, page 487; McCulloch's Edit., 1828.

ern continent postponed the catastrophe for more than a century, but each year now brings visibly nearer the crisis which the financiers of 1775 foresaw. To us, looking back over the past, the process of the formation of the new nucleus of empire can be precisely traced. Clearly it originated in the conflict between the rival forces in Europe, and could hardly have gained cohesion otherwise. France and England being hostile, the adhesion of the thirteen colonies to either side turned the scale. In the Seven Years War England and the colonies defeated France, and expelled her from the terminus she had acquired beyond the Alleghanies. In the Revolutionary War, the colonies aided by France overcame England and ejected her from her base upon the Hudson and the Chesapeake, from whence alone, she, at that time, could extend her system over the valley of the Mississippi. Lastly, in the negotiations for peace, after the surrender of Yorktown, the relations between belligerents and allies were nearly reversed.

The French did not engage in a long and costly war for love of American liberty, but to regain what they had lost. The government of Louis XVI hoped not only to weaken England in America, but also to exclude Americans from the Mississippi; for, by doing so, they would strengthen Spain in Louisiana and Florida, and they had reason to believe that at a given moment, they could secure the land nominally held by Spain for France.

The French were foiled because, in the hour of victory, they were abandoned by their allies who wanted the Mississippi themselves, and who did not hesitate to speculate upon the hatred and fear of England for her most redoubtable antagonist. Mr. Jay is reported by John Adams, thus to have expressed himself: "Our allies don't play fair, he [Mr. Jay] told me; they were endeavoring to deprive us of the fishery, the western lands, and the navigation of the Mississippi; they would even bargain with the English to deprive us of them; they want to play the western lands, Mississippi, and the whole Gulf of Mexico, into the hands of Spain."* John Adams sympathized with his colleague. One day in conference, "I could not help observing, that the ideas respecting the fishery appeared to me to come piping hot from Versailles." That our advantage in being nearer "had ever been an advantage to England, because our fish had been sold in Spain and Portu-

* Works of John Adams, 3, 303.

gal for gold and silver, and that gold and silver sent to London for manufactures; that this would be the course again; that France foresaw it, and wished to deprive England of it, by persuading her to deprive us of it; that it would be a master stroke of policy if she could succeed, but England must be completely the dupe before she could succeed.

"There were three lights in which it might be viewed: 1. As a nursery of seamen; 2. As a source of profit; 3. As a source of contention. As a nursery of seamen, did England consider us as worse enemies than France? Had she rather France should have the seamen than America? The French marine was nearer and more menacing than ours. As a source of profit, had England rather France should supply the markets of Lisbon and Cadiz with fish, and take the gold and silver, than we? France would never spend any of that money in London; we should spend it all very nearly." *

Such arguments brought conviction, and thus it happened that as between two belligerents who hated and feared each other more than they hated the third party who lay between them, the United States upon most contested points obtained the advantage.

Thirty years separated the mission of Washington to Duquesne from the acknowledgment of independence by the treaty of 1783, seventeen of which were consumed in actual fighting, and at the close, though the great terminus of the world's trade-routes had been severed from the European economic systems, the process of consolidating the scattered fragments of American territory in an administrative mass had hardly begun. There is no escape, therefore, from the inference, that it had cost two wars of the first magnitude to force the population of this continent through the initial phases which every community must traverse before its territory can become the seat of international exchanges. Moralists may theorize as they will, but the displacement of energy and wealth which attends the migration of the world's central market, or, in other words, the seat of empire, involves the life and property of millions of human beings, and men have never yet learned to surrender these possessions by appeals to abstract principles.

At the outset, in America, the tendency toward repulsion between the parts, almost equalled the pressure which caused cohe-

* Works of John Adams, 3, 328.

sion. In Virginia in 1861 repulsion finally prevailed, and yet Washington, perhaps more perfectly than any other man, personified the principle of consolidation. Probably he did so because of the quality of his mind. Washington possessed in a high degree the organizing and administrative intellect which has reached its highest development in soldiers like Alexander, Caesar, and Cromwell. Washington had the contempt of the practical man for abstractions. He understood that to succeed in their struggle with competitors his countrymen must act with energy and unity, and that without common material interests which could only be nourished by converging arteries of commerce, the United States could never solidify.

I wish it were possible for me to give you an abstract of Washington's correspondence touching American centralization. As it is, a fragment must serve by way of suggestion, but, I may say at the outset, that Washington's education in ideas which now would be called imperialistic began when he was yet a boy, and continued without interruption until he died. They were the ideas of an acute and far-sighted man of business, who was also a man of the world. When about sixteen, Washington was sent to survey the wild region beyond the Blue Ridge, and after his campaign against Fort Duquesne he became convinced of the "practicability of an easy and short communication between the waters of the Ohio and Potomac, * * * and of the policy there would be in this State and Maryland to adopt and render it facile."*

Long before the Revolution his travels through the wilderness had taught him the great features of American physical geography, and his instinct as a man of business made him recognize the Valley of the Mississippi as the certain terminus of the eastern trade which, after the victories of Clive and Wolfe, had become fully centered in London. Given the chief market and the terminus, it only remained to determine the route, and he forthwith bent his energies toward opening the Potomac as the avenue of communication. All his interests lay upon the Potomac, and he knew that those who lived upon the great highways of commerce are those who rise to power and wealth. Perhaps his earliest and his most cherished ambition was to carry through the construction of the Potomac Canal.

* Washington to Jefferson, 29 March, 1784, Sparks, 9, 30.

On July 20, 1770, he wrote to Governor Johnson of Maryland: "There is the strongest speculative proof in the world to me of the immense advantages which Virginia and Maryland might derive (and at a very small comparative expense) by making Potomac the channel of commerce between Great Britain, and that immense Territory; * * * the advantages of which are too great, and too obvious, I should think, to become the subject of serious debate, but which, through ill-timed parsimony and supineness, may be wrested from us and conducted through other channels. * * * How difficult it will be to divert it afterwards, time only can show." *

He then conceived the idea of the Potomac Canal, and as he afterward explained to Jefferson, in 1784, the plan "was in a tolerably good train, when I set out for Cambridge in 1775, and would have been in an excellent way, had it not been for * * * the opposition which was given * * * by the Baltimore merchants, who were alarmed, and perhaps not without cause, at the consequence of water transportation to Georgetown of the produce, which usually came to their market by land." "But with you I am satisfied that not a moment ought to be lost * * * as I know the Yorkers will delay no time to remove every obstacle in the way of the other communication so soon as the posts of Oswego and Niagara are surrendered." †

The more Washington reflected upon events the more he became penetrated with the predominating influence of trade-routes, and the more he rebelled against the imbecility of conservatism. He saw that the British could not be expelled from Oswego and Niagara, and, therefore, that Lake Erie and the West must remain closed to New York; he saw that lack of cohesion among the States left them open to hostile discriminations by foreign nations, and in his own case he had experienced the paralysis with which local jealousies struck all enterprise when the undertaking transcended the bounds of a single community. Abroad and at home Washington saw the country losing in the race because the people lacked energy to discard tradition, and pursue "a wise, just, and liberal policy toward one another, and keep good faith with the

* Washington to Johnson, Congressional Documents, 1st Session, 19th Congress, Report No. 228.

† Washington to Jefferson, Sparks, ix, 31, 32.

rest of the world." * In 1786 he wrote in despair to Jay: "I do not conceive we can exist long as a nation without having lodged somewhere a power, which will prevade the whole Union in as energetic a manner as the authority of the State governments extends over the several States."†

Yet, in spite of momentary depression, Washington was endowed with unfailing energy, and unerring instinct. He saw in the first place, that if he could make the Potomac a leading highway to the West he would establish the fortunes of Virginia upon a rock; and, in the second, that if he could accomplish this result he would bring the chief market of the Union somewhere near the geographical centre of the nation, that consolidation must follow, and that in proportion as the nation consolidated it would gather vitality. Therefore he addressed himself to the task of building the Potomac Canal, and though he failed to accomplish his immediate object, his exertions to secure unity of action among the different States which had to co-operate to grant the necessary franchises to his corporation, were the approximate cause of the calling of the convention which framed the constitution.

In 1784, Washington having made a tour through the West, wrote to Governor Harrison urging legislation. He followed up this letter by visiting both Annapolis and Richmond, and in January, 1785, obtained a charter for his proposed company. In the spring, the share-owners chose him President, and the next August he examined the Potomac from Georgetown to Harper's Ferry with a view to immediate construction. Subsequently, as Maryland and Virginia had to unite upon some scheme to settle questions of jurisdiction, Washington gathered representatives of both States at Mount Vernon, and this commission prepared a report. Since it appeared to the commissioners, however, that the portage between the eastern and western waters would pass through Pennsylvania, they decided that Pennsylvania must be induced to co-operate. The Maryland Legislature, also, when it approved the compact, pointed out to Virginia that Delaware should be consulted, since a canal between the Delaware River and the Chesapeake would be indispensable, and if this were the case it might be prudent to convene commissioners from all the States to consider the general question of commerce.

* Washington to James Warren, October 7, 1785, Sparks, ix, 140.
† Sparks, ix, 187.

This suggestion commended itself to the Virginia Assembly, and invitations were issued for a meeting at Annapolis in September, 1786. In September, only five States being represented at Annapolis, the delegates could think of nothing better to do than to petition Congress to call a convention at Philadelphia to devise means to make "the constitution of the Federal Government adequate to the exigencies of the Union." After long hesitation Congress issued the call, Virginia sent Washington as a delegate, Washington presided over the convention and then naturally became the instrument which set the new mechanism in motion.

At Washington's inauguration the fragments of empire coalesced, and the United States became a social mass capable of sustained and energetic action. Since that event the quality of the administration has varied at different epochs, but, on the whole, the direction of the movement of the nation has been constant, external and internal phenomena reacting on each other and both contributing to the same result.

Washington served as an excellent medium through which the instinct toward centralization first found vent. He comprehended the economic character of the conflict which was raging abroad, and his policy of neutrality was conceived with the purpose of profiting by it to the utmost. "My policy has been, and will continue to be, while I have the honor to remain in the administration, to maintain friendly terms with, but be independent of, all the nations of the earth; to share in the broils of none; to fulfill our own engagements; to supply the wants and be carriers for them all; being thoroughly convinced, that it is our policy and interest to do so."* Clearly Washington was right. If America could stand between France and England she could not fail to achieve fortune by collecting the debris scattered broadcast in the struggle. You can appreciate Washington's foresight, for you know how the United States has profited and still profits by the jealousy of European powers. You have served in the war with Spain. As early as 1803 the harvest began. Defeat put Bonaparte in a position, after the catastrophe of Saint Domingo, when he seems to have doubted his ability to defend the mouth of the Mississippi against England. His conversation leads to the inference that he sold Louisiana to the United States to keep the province from

*Washington to Morris, 22 Dec., 1795, Sparks, xi, 102.

Great Britain, and if, beside, by reason of his gift he could kindle war between the United Kingdom and the United States, France would be repaid for her loss.

Perhaps Napoleon may have succeeded in his design. The West received a great impulsion by the acquisition of Louisiana without which it might not have generated the energy which found expression through Clay, and which was certainly a factor in determining the rupture of 1812. On the other hand the Mississippi tempted Great Britain, as is demonstrated by the fact that her most vigorous campaign was directed against New Orleans. However this may be, I apprehend that incontestably Louisiana gravitated toward the greatest social mass upon the continent in obedience to a natural law, a law which has controlled the destiny of the members of the Spanish empire, as they have separated themselves from the parent system, in proportion as the vitality of that system has waned.

Meanwhile, during the years which followed the cession, Great Britain grew arrogant through victory, and after Trafalgar pursued a policy which is hardly explicable unless we assume that half unconsciously the English determined to venture an attack at a moment when the inchoate empire of the West might still be resolved, under pressure, into its component parts.

Men fight to defend what they conceive to be their interests, but, generally, the only interests which stir them are those which are obvious. It is this tendency to ignore the future which has always been the greatest peril of America, and it is this tendency which Washington deplored. "It is to be regretted, I confess, that Democratical States must always *feel* before they can *see;* it is this that makes their governments slow." *

Viewed thus the imbecility of Mr. Madison's administration becomes explicable. The conception of national unity was too remote to stimulate. Many New Englanders regarded Mr. Jefferson with more aversion than Lord Liverpool, and submission to England as less hateful than submission to Virginia. Hence Massachusetts refused to confide the command of her militia to a national officer, even in the extremity of peril, and profited by defeat to prepare for secession.

* Washington to Lafayette, 1785, The Writings of George Washington, Ford, x, 478.

The United States with a population of 7,000,000 had ample resources had she cared to use them. But American citizens, in 1814, after having seen their frontiers violated, their capital burned, and their ships hunted from the sea by overwhelming fleets, sat at home, and, refusing to maintain 30,000 men in the field, abandoned their armies to their fate. Only four days after the victory at Fort Erie, at the most critical moment of the Niagara campaign, General Brown wrote to Secretary Armstrong: "I very much doubt if a parallel can be found for the state of things existing on this frontier. A gallant little army struggling with the enemies of their country, and devoting their lives for its honor and its safety, left by their country to struggle alone, and that within sight and within hearing." *

This was the General Brown, who, a month before at Lundy's Lane with a loss of 853 men out of less than 2,000, defeated upwards of 2,600 of the best soldiers of England. And when Brown thus asked for aid he was preparing to defend the key to the West against an overpowering force of Peninsula veterans who had been made available by the fall of Napoleon.

As I read the history of that time, not without a sense of shame, I wonder how Great Britain could have missed attaining the end for which she fought the war, which was to sever the Mississippi Valley from the Atlantic States. At Ghent, when negotiations began, she demanded as the price of peace the surrender of the interior as far as Ohio, and also of the shore of the Lakes. If she subsequently modified these terms it was only because Wellington advised the Cabinet that from the military standpoint such pretensions were untenable.

I have often asked myself whence came this resistance which the men who had driven Bonaparte from Spain hesitated to encounter, and the only answer I can formulate is that it came from the regular army and navy. I apprehend, therefore, that if to-day we are a great and united nation, we owe our fortune to the courage and devotion of the handful of soldiers who formed our regular army, who against great odds won the victories of Chippewa, of Lundy's Lane, and of Fort Erie; and perhaps even more than to these, our gratitude is due to the sailors who destroyed the hostile fleet upon Lake Erie, and crushed the enemy on Lake Champlain.

* History of the United States, Henry Adams, 8, 218.

Little as consolidation did toward creating patriotism during the early years of this century, it gave us a national military service; and our army and navy saved the republic when civilians proved untrue to themselves.

Meanwhile, after Leipsic, France sunk into exhaustion, and the allies met to negotiate the basis on which they could establish peace. I cannot now analyze the later campaigns of Bonaparte. I must content myself by saying that although Russia and Germany had been forced temporarily to support England in order to free themselves from the French domination, the old antagonism still subsisted between the continental and insular economic systems. The trade-routes which connected the continent and the United Kingdom with the East were parallel and competing. Hence England remained jealous of the Holy Alliance; and, having failed to dismember the United States, prepared to use her as an ally to keep in check France and Russia while she made for herself all the profit possible out of the decay of Spain. On her side, the United States acceded to this policy, for she saw, in the future as in the past, an abundant harvest to be reaped by gathering in fragments of that huge and rotting empire, as fast as she found herself able to absorb them.

The respite after Waterloo which brought such general relief to Europe, availed the Spanish little. Society was diseased to the core. Unable alike to conquer the revolted colonists, or to make terms with them, Spain fell a victim to England, who, under the threat of immediate recognition of her dependencies, extorted trade concessions more advantageous than she could have enjoyed under any other conditions. She supplied both the belligerents with material of war.

Thus while Castlereagh and Canning combined with the administration of Mr. Monroe to compass the dismemberment of Spain, the Holy Alliance opposed them, not only in the interests of conservatism, but because the allies hoped when the supreme hour should come, that they might be able themselves to divide the inheritance of the sufferer.

As usual the prizes fell to the United States. The rest got nothing. Our people determined to have Florida, and as the Spaniards were unable to maintain order in the province, excuses for invasions were plenty. So Spain yielding to the inevitable, agreed, in 1819, to sell Florida to the Union, but even then, when the

treaty reached the king, it hung in doubt. Powerful influences opposed the cession, and the Cabinet at Washington finally lost hope. Not so Mr. Rush, who living at London, could better observe the reaction upon each other of the opposing forces. Nevertheless, being anxious, he one day asked Lord Castlereagh if Great Britain were opposing his government at Madrid. He at once received the assurance that so far "as we have given expression to any opinion or wish to Spain, it has been that the treaty may be ratified."

Presently the reason for this complaisance transpired. Mr. Rush's interview occurred in August, 1819. In March, 1820, a revolution in Spain overthrew Ferdinand VII, and restored the constitution of 1812. In 1822, the United States recognized the independence of the South American republics, and in the following September Chateaubriand pledged France at the congress at Verona to sustain Ferdinand by force. Afterward Chateaubriand boasted that his purpose in armed intervention was to put France in a position to be able to establish several Bourbon monarchies in America to counterbalance the influence of England and the United States.

No sooner did Mr. Canning divine the purpose of the allies than he besought Mr. Rush to join with him in a declaration which would avert the danger. Mr. Rush, however, was without instructions, and declined to act unless England would join the United States in the recognition of the colonies. This proposition Mr. Canning rejected, for his object was to use the United States to gain a certain end, not to compromise himself in her action. His hesitation cost his country dear, for it gave Mr. Monroe the command of the position. In November, Mr. Canning received assurances from M. de Polignac, the French ambassador at London, of the pacific intentions of the king. Though a little doubtful of French sincerity, Mr. Canning thereupon dropped his negotiation with Mr. Rush; but meanwhile Mr. Rush's dispatches had reached Washington, and Mr. Monroe's Cabinet prepared to act. The opportunity was one which rarely presents itself in a nation's history. The weakest of three rivals imposed its terms upon the two strongest. The jealousy between Great Britain and the Holy Alliance made both incapable of movement. The continental powers dreaded the British fleet, and Mr. Rush pointed out that Great Britain had called in the aid of the United States

because she feared France. The inference was, therefore, that she would not resist the United States, should the President oppose France, even though he used unpalatable methods. Mr. Rush wrote on October 10, to the Secretary of State: "It appears that having ends of her own in view, she [England] has been anxious to facilitate their accomplishment by invoking my auxiliary offices as the minister of the United States at this court; but as to the independence of the new states of America, for their own benefit, that seems quite another question in her diplomacy. It is France that must not be aggrandized, not South America that must be made free." * Thus Mr. Monroe standing between France and England became the arbiter of the destiny of this continent, and in his message to Congress on December 2, 1823, he laid down the famous principle that he would tolerate no further European intrusion upon the western continent.

Gentlemen, that is the Monroe Doctrine. We oppose the establishment of a base of operations against us, by either of the two competing European systems, upon this continent; and the principle should be extended even more emphatically to China, for he who possesses China will possess the richest beds of mineral in the world, and will almost infallibly, sooner or later, gain control of the canal which will cross the Isthmus of Panama. That canal will be not only a route to the European market, but the cheapest highway from the mineral region of the East to the unoccupied domain of the valley of the Amazon which is now awaiting development. Thus England holds Egypt.

Mr. Monroe only elaborated the principles laid down by Washington. He gained his point, as Washington gained his, by balancing London against Paris, as we now balance London against Berlin. That principle of counterpoise had been in silent operation since the Seven Years War. It received articulate expression in 1823. Since then it has been our recognized rule of action. By its means we have already digested Louisiana, Florida, the better half of Mexico, Porto Rico and the Philippines. We have driven the French from Mexico, which we reserve for the future, as we also reserve Cuba. We are safe as long as we divide our antagonists, but the danger will come hereafter. Sooner or later, unless we are

* John Quincy Adams: His Connection with the Monroe Doctrine, Ford, 57.

especially favored by fortune, the United States will have grown so formidable, that both the old systems will turn upon her to rend her.

The Monroe Doctrine theoretically concerns only foreign relations, but foreign affairs reflect a nation's energy, and energy is developed in proportion to the mass consolidated. In America consolidation has followed an easily recognizable law.

When Washington was inaugurated, the territory he undertook to administer lay in a narrow belt between the mountains and the sea, a belt not over three or four hundred miles deep, and some thirteen hundred long. There were few industries, and practically no surplus manufactures. The agricultural products were floated down the rivers, and those exported went mostly to England. Land transportation was costly in the extreme. Hence intercommunication was difficult, the central market lay beyond the sea, and community of interest was impossible since the roads converged at London, a point distant from the frontier.

Under such conditions, a policy which favored one section, almost necessarily depressed another, and each province in turn proved restive when its livelihood was imperilled. Thus Massachusetts meditated secession when the embargo ruined her merchants, and South Carolina, as late as 1832, resorted to nullification, when the tariff lessened the purchasing power of the cotton crop.

Nothing could ameliorate such conditions but an extension westward of the territory which found its outlet upon the Atlantic, until the length of distance to be travelled, and the increase of various industries seeking sale, permitted of the convergence of highways at some market in America itself. Washington comprehended the situation, and the two cardinal principles of his policy were the cheapening of internal communications, and the encouragement of native industries. Hamilton's famous report on manufactures, sent to Congress in December, 1791, has always remained the basis of American industrial legislation; while the construction of canals became with Washington almost a fixed idea. Yet, though many men, even in the south, accepted the whole theory of consolidation, as propounded by Washington and Hamilton, few or none understood the geographical formation of the continent sufficiently to judge where the paths of least resistance lay, and where, consequently, the future commercial centre would be situated. So intelligent a man as Madison considered New

York as hopelessly eccentric, and therefore unfit to be a national capital: "New York has appeared to me extremely objectionable [for a capital] on the following grounds: It violates too palpably the simple and obvious principle, that the seat of public business should be made as equally convenient to every part of the public, as the requisite accommodations for executing the business will permit. * * * The extreme eccentricity of the latter [New York] will certainly, in my opinion, bring on a premature and consequently an improper choice. People from the interior parts of Georgia, South Carolina, North Carolina, Virginia and Kentucky will never patiently repeat their trips to this remote situation."*

Washington himself, in a letter written in 1796 to Sir John Sinclair, in reply to questions regarding the value of real estate in America, thus explained his views in reference to the future: "I do not hesitate to pronounce, that the lands on the waters of the Potomac will in a few years be in greater demand and in higher estimation, than in any other part of the United States. * * * I will request you to examine a general map of the United States. [You will see that] the main river runs in a direct course to the expanded parts of the western country, and approximates nearer to the principal branches of the Ohio, than any other eastern water, and of course must become a great, if not * * * the best highway into that region; that the upper seaport of the Potomac is considerably nearer to a large portion of the State of Pennsylvania, than that portion is to Philadelphia; * * * that the amazing extent of tide navigation, afforded by the bay and rivers of the Chesapeake has scarcely a parallel.

"When to these is added, that a site, at the junction of inland and tide navigations of that river is chosen for the permanent seat of the general government, * * * that the inland navigation is nearly completed, to the extent above mentioned; that its lateral branches are capable of great improvement at a small expense, * * * through which * * * an immensity of produce will be waterborne, thereby making the Federal City the great emporium of the United States; * * * I am under no apprehension of having the opinion I have given * * * controverted by impartial men."†

* Madison to Washington, 24 August, 1788, Writings of Washington, Sparks, ix, 550.

† Washington to Sinclair, Sparks, xii, 326, 327.

In short, Washington expected the Federal city to become a capital, if not "as large as London, yet of a magnitude inferior to few others in Europe." *

Had Washington's prevision proved even partially correct the Union would have had a different destiny, for there could probably have been no sectional division sharp enough to breed a war of secession. Although the economy of transit by the Great Lakes would finally have given a superiority to New York, yet had Virginia been able to utilize the Potomac a considerable market might have flourished within her borders, fed by avenues leading north as well as south. In that case her interest would have favored the Union, and without Virginia no movement toward secession could have been formidable. Washington erred partly because he could not foresee the coming of railways, and partly because his education prevented him from realizing the inaptitude of the old Virginian society for industry. With slavery, the process of consolidation became more and more repugnant to the governing class; Washington himself had no successors; the Virginian presidents who succeeded him inclined toward decentralization, and Mr. Monroe actually vetoed a bill passed by Congress to provide for the maintenance of the Cumberland Turnpike, without which Virginia could make no headway against Pennsylvania and New York.

That the fate of Virginia and the South was decided by her inability to control any of the principal avenues leading west is proved by the sequence of events. In early days Virginia was the base of emigration across the mountains. One path led by Cumberland Gap and Boone's road to the banks of the Kentucky; the other by the Potomac to Cumberland and from Cumberland to Pittsburg or Wheeling. The last was the route followed by the National Turnpike, whose effect on liberty Mr. Monroe feared, and was the main line leading west up to the building of the Erie Canal. The great northern artery by Niagara and the lakes was little used, partly because Oswego, Niagara and the more important points were long in hostile hands; but for whatever reason, when Clinton made his survey for the Erie Canal, in 1810, he found Buffalo a village with some forty houses.

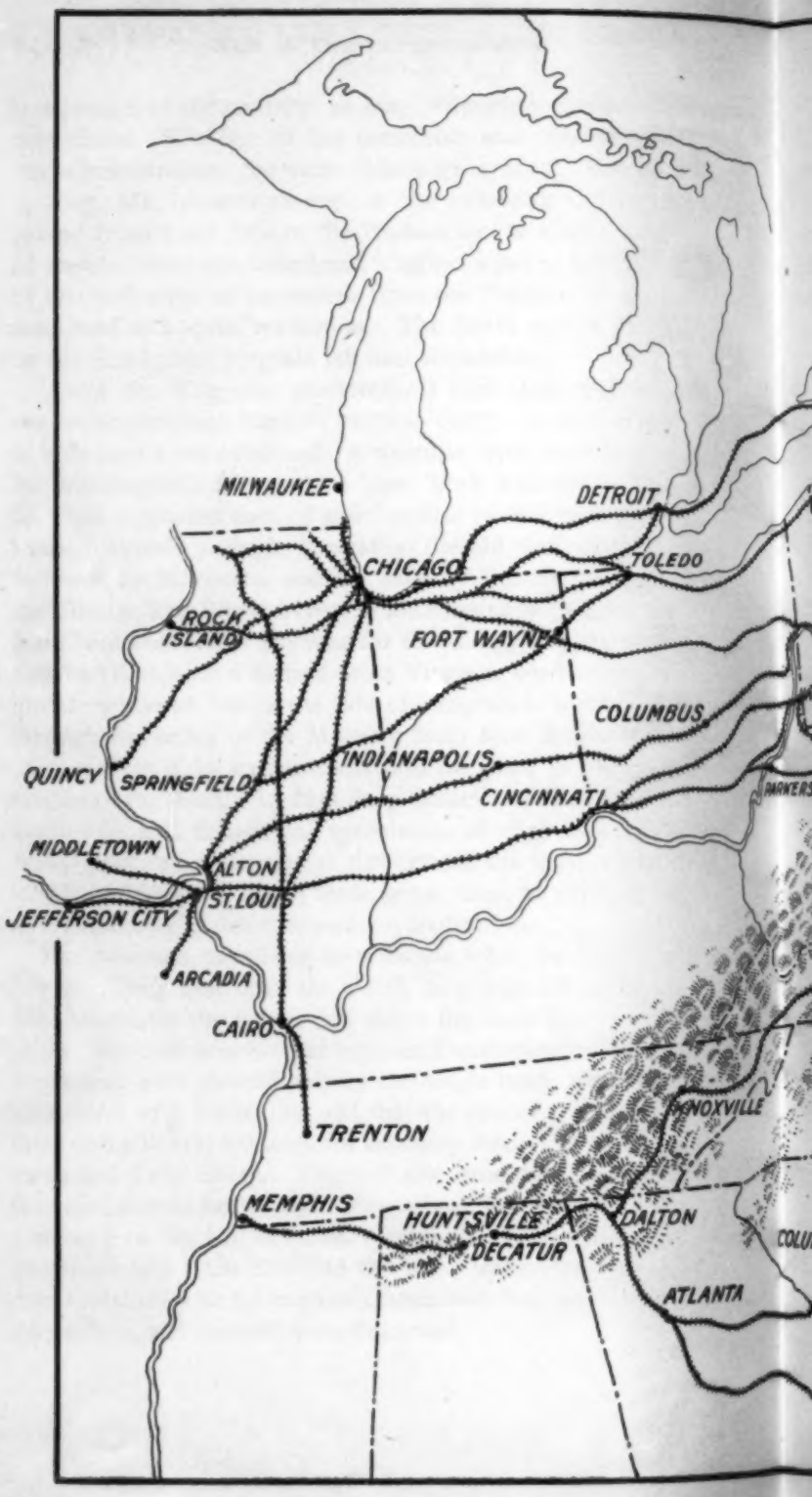
So long as the Cumberland turnpike remained the dominant

* Washington to Mrs. Fairfax, 16 May, 1798, Sparks, xi, 233.

trade-route of the country, so long Virginia remained the dominant State. The line of her presidents was unbroken, save for one administration, for more than a generation. But on March 4, 1825, Mr. Monroe retired, in the following October Clinton passed from Lake Erie to the Hudson by the Canal, the channel of travel shifted northward and Virginia's power fell. The effect of this deflection of movement from the Potomac to the Hudson amounted to a social revolution. The North gained prodigiously on the South, and Virginia fell into eccentricity.

Under the Virginian presidents, it cost about $88 to move a ton of freight from Niagara to New York. In 1835 it cost $4.90 to transport a ton of mixed merchandise from Buffalo to Albany. In Washington's life western New York was still a wilderness. In 1850, 1,370,000 tons of merchandise passed through the Erie Canal. Within a single generation the old trail which had been followed by Marquette and La Salle by Detroit, Mackinaw, and the Chicago and Illinois rivers to the Mississippi, became the dominant trade-route and the vent for the energy of the nation. Illinois had first been colonized from Virginia, but the Virginian influence withered before the tide of emigration which surged out through the valley of the Mohawk from New England, and Chicago rose as if by enchantment into the place of the paramount market of the West. In 1835 the population of Chicago multiplied eight fold, and though the speculation of 1835 was followed by bankruptcy and collapse, yet through all the years of depression which followed, the grain trade grew, until in 1850 the building of the railroads began to transform civilization.

The railroads completed in a decade what the Erie Canal had begun. They destroyed the South as a separate system. I ask you to examine the map which shows the main lines of railway in 1858. You will observe that between Cumberland and Atlanta the mountains were pierced only by the single track which connected Richmond with Knoxville, and that the grades on this road were then, and still are, too steep for economy relatively to the Pennsylvania and Lake Shore. You will also note that Virginia had by that time succumbed to Baltimore, whose jealousy more than half a century earlier had defeated Washington's enterprises. By the Baltimore and Ohio Railroad the Ohio Valley was brought into direct relation with the head of Chesapeake Bay, and Washington, Alexandria, and Norfolk were discarded.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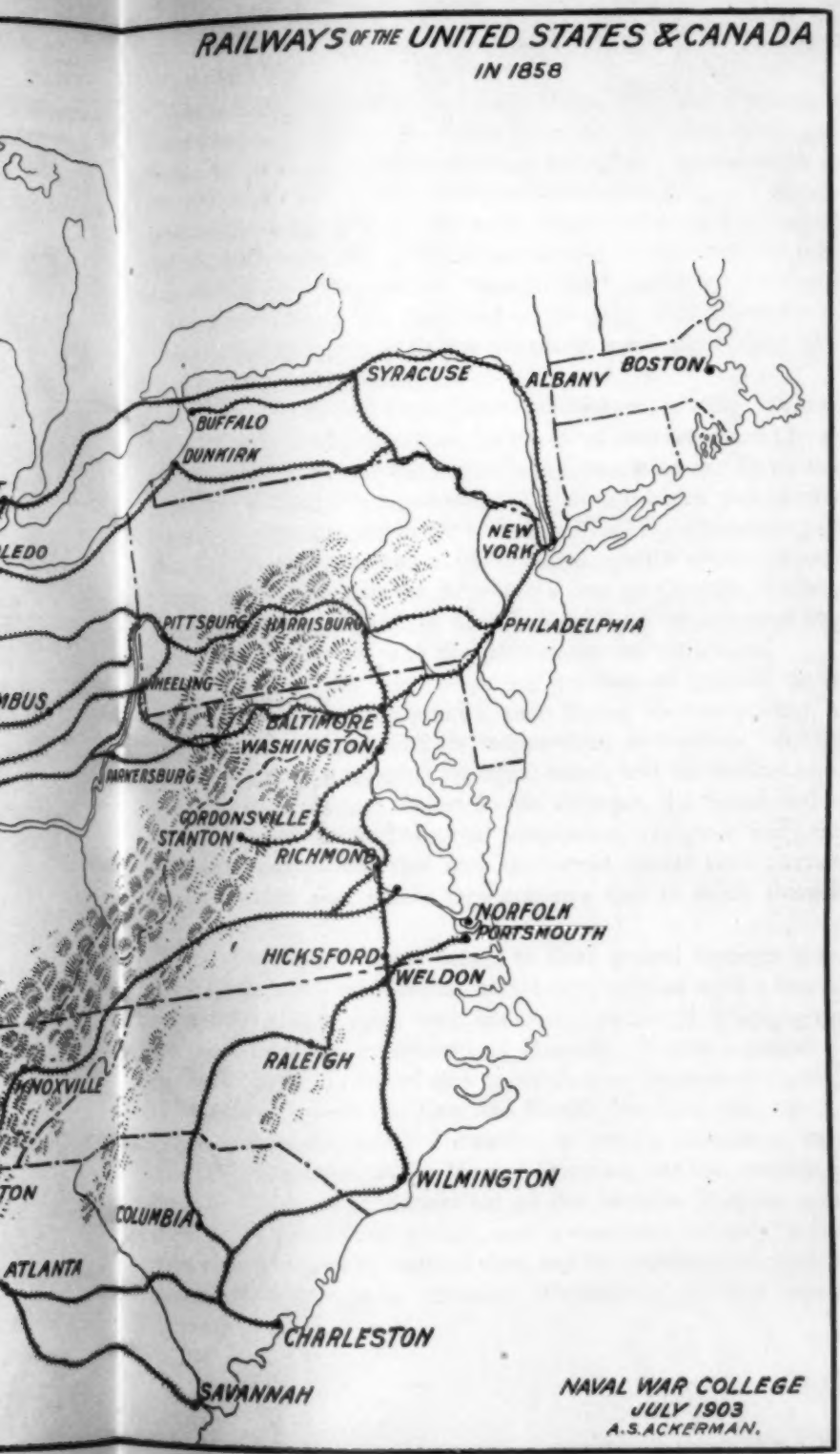
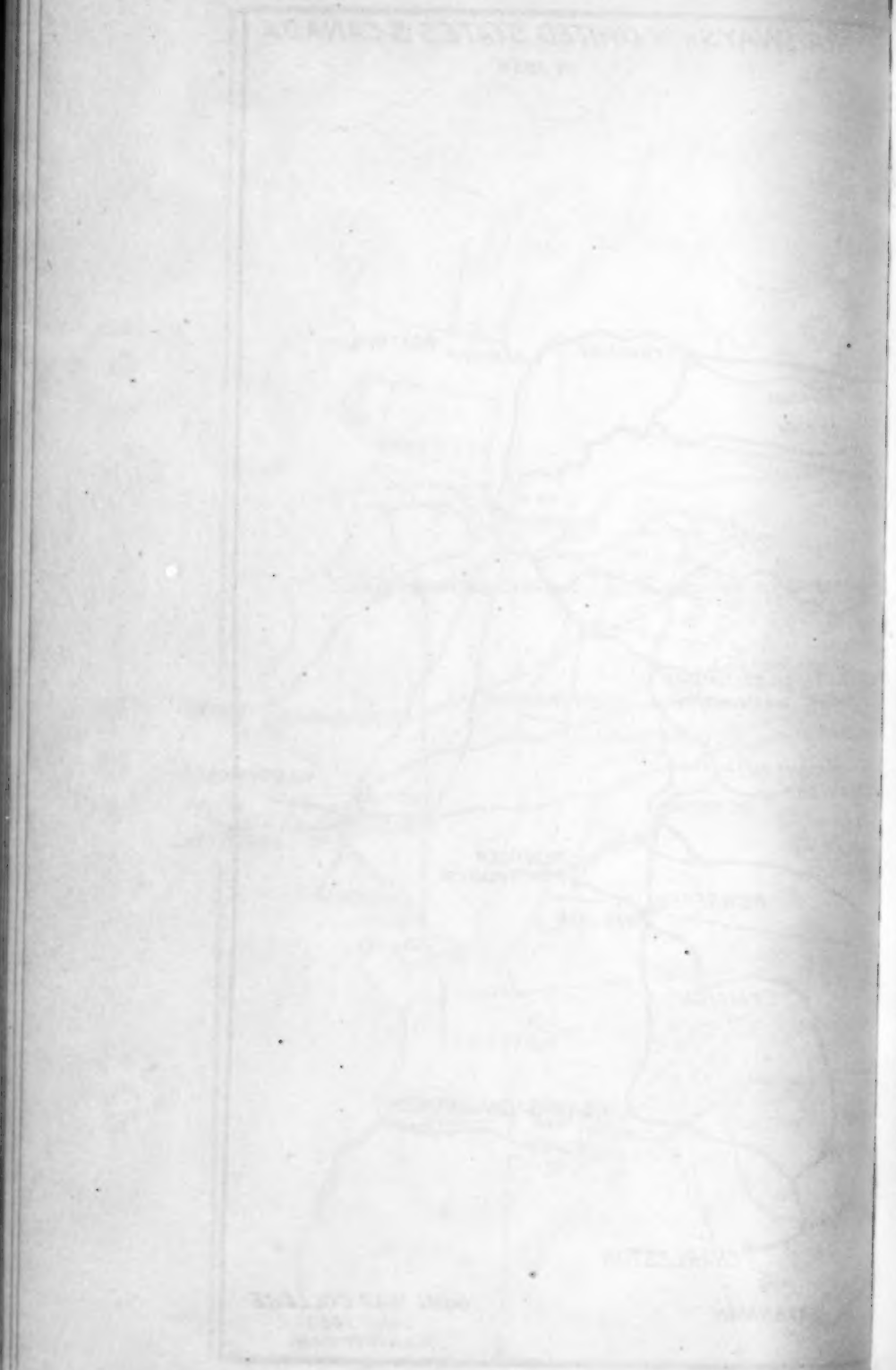
JEFFERSON CITY
ARCADIA
CAIRO
TRENTON
KNOXVILLE
MEMPHIS
HUNTSVILLE
DALTON
DECATUR
ATLANTA


RAILWAYS OF THE UNITED STATES & CANADA
IN 1858
SYRACUSE
ALBANY
BOSTON
BUFFALO
DUNKIRK
NEW YORK
PITTSBURG
HARRISBURG
PHILADELPHIA
WHEELING
BALTIMORE
WASHINGTON
PARKERSBURG
CORDONSVILLE
STANTON
RICHMOND
NORFOLK
PORTSMOUTH
HICKSFORD
WELDON
RALEIGH
WILMINGTON
COLUMBIA
CHARLESTON
SAVANNAH
NAVAL WAR COLLEGE
JULY 1903
A.S.ACKERMAN.



You see at a glance that the coast States, from the Potomac to Charleston, were severed from the West, and that Charleston controlled but one outlet, which ended at Memphis. To the north on the contrary, a network of thoroughfares converged at Chicago, whence the larger part of the traffic reached the sea by Niagara and the Hudson, while a substantial portion, attracted by the mineral development of western Pennsylvania, passed by Pittsburg. Consequently the South remained semi-torpid, and the mines of Virginia undeveloped, while the northwest grew vigorously, with Chicago for a metropolis.

In 1850 Chicago had about 30,000 inhabitants; in 1860, 112,000; and Chicago's rise to supremacy in the West was recognized by its choice as the city where the Republican Convention should be held in 1861. It was this supremacy of Chicago which precipitated the war of secession, for in 1861 the South had the alternative presented it of being absorbed in the economic system which connected the Mississippi with the Atlantic by way of Chicago, Buffalo, Pittsburg and New York, or of defending itself by measures that would be incompatible with the maintenance of the Union.

It was the old but ever-recurring question of parallel trade-routes between the same termini, each having its own portion of tributary communities, and its independent civilization. As the two could not exist together on equal terms, and the weaker must sooner or later become subject to the stronger, the South had to choose between war and eventual submission. It chose war; and experience has proved that men uniformly, under such circumstances, choose war, where they conceive that in battle there is hope of victory.

Thus the United States seems to have passed through three distinct phases of consolidation, and to have entered upon a fourth.

The first phase began with the inauguration of Washington, and lasted until the retirement of Monroe. It was a period of territorial accretion, but of slow centralization because of the lack of highways between the East and West. Its close was marked by two phenomena which I conceive to have a relation to each other; the declaration of the Monroe Doctrine, and the opening of the Erie Canal. The declaration of the Monroe Doctrine indicated a rise in national energy, and a tendency toward greater unity of purpose, for it received then, and has continued to receive, general popular support. Neither Washington nor any subse-

quent president, up to Mr. Monroe, was so fortunate as to be able to concentrate the community behind him, when he dealt with those who controlled the markets abroad to which the different sections of the Union were tributary. With the opening of the Erie Canal the first traces are to be observed of the formation of lines long enough to converge within our own territory; and indeed, it was not many years later that the pressure of protection, which was created by the growth of northern industries, precipitated the nullification movement in South Carolina. Nullification was the refusal of cotton planters to be taxed in aid of manufactures in Pennsylvania and New England. South Carolina insisted on being allowed to buy and sell in England where she could trade to more profit than in Boston or New York.

The second period opened in 1825 and extended to the Civil War. It was an interval of very rapid improvement in communication, and of corresponding growth of the national instinct. This national instinct found expression through orators like Webster, and soldiers like Jackson, who when president, threatened to deal summarily with nullification. On the other hand the tendency toward consolidation was resisted by the South, the weaker competitor, and this resistance culminated in 1861 in war.

The third period dates from 1865. In 1865 the independent southern system had been crushed, and the civilization which had been its product had been destroyed. The United States had become centralized upon those lines of communication which extend from the Pacific to the Atlantic, and which converge at Chicago and New York. There was no further resistance at home, but it remained to be determined whether America could complete her communications and industrial works, and operate them at a profit in competition with Europe. In 1865 the United States had little accumulated capital in proportion to the task before her, and she entered upon her enterprise with borrowed money. The constructive period lasted about 25 years, at whose end foreign creditors demanded payment of their loans. It is impossible now, and would be useless, to enter into the details of what followed. It suffices to say that in 1894, when all the surplus gold of the country had been exported, it became apparent that unless the prices of manufactures could be depressed to the point where we could pay our debts by the medium of merchandise, in-

stead of by the medium of bullion, the country would ultimately become bankrupt, and would, probably, break down.

After a period of social convulsion which lasted some four years, Pittsburg succeeded in underselling all competitors in steel, and almost instantly the conditions changed. The ships of the world could not convey our products to foreign lands, we paid our creditors with ease, wealth accumulated as it had never accumulated before. In 1899 we had became the greatest of industrial communities. We consumed the most cotton in our mills, we mined the most iron ore, we manufactured the most steel, we raised and burned the most coal. Our railways were the most perfect and the best equipped and yet they operated, cheapest. In a word, consolidation had done its initial work. The country had expanded westward until its roads could meet at a point within its own borders, and at the same time it had so improved its administrative processes, that at the point where its roads met it could control the market. Instead, therefore, of being longer a nucleus lying at the extremity of two economic systems and serving them both as a terminus, the United States had herself become the seat of empire, and the point where both European and Asiatic trade-routes promised to converge.

You will perceive, without further words from me, what this revolution must portend, if such a revolution has indeed taken place; and that it has taken place is hard to doubt. You have only to look abroad at the relative place which England held 50 years ago, and compare it with the place she holds now. You know what the ablest Englishmen think. So long as London remained the dominant market all highways led to the Thames, and the English empire cohered naturally. Now Mr. Chamberlain says, and says, probably, truly, that unless Britain can pay her colonies to remain with her, her empire must dissolve. But the dissolution of the British empire would logically be one effect of the transfer of the centre of gravity of human civilization from the eastern to the western continent.

Under such circumstances we can address ourselves to no graver task than to examine the effect of the forces which have been in action during the past, in order that we may form some estimate of the probable demands which may be made upon us in the future. To-morrow I shall present certain deductions relating to these phenomena, which may not be unworthy of the consideration

of the Staff of the American Navy whose duty it is to guard the safety and honor of our country.

Gentlemen:—Yesterday I asked you to follow the growth of the United States from a wilderness which promised to become a prospective terminus for two competing European economic systems, to the present time when she is apparently developing into a gigantic empire. To-day, with your permission, I shall try to analyze the causes which led to Great Britain's high-fortune, in order that, by comparing the history of the last great consolidation with the present, we may adduce principles which may guide us in the future.

We may assume, I think, that England entered upon her grand career shortly after the victories of Clive and Wolfe, and that the year 1761 may be fixed as a convenient starting point when the Duke of Bridgewater opened the canal which connected his coal mines with Manchester, and thus gave that city cheap fuel. No one will dispute that this event approximately marked the advent of the phenomenon called the "Industrial Revolution," when all social movement was accelerated by canals, by railways, and by steam. From 1761 Great Britain advanced fast in wealth and power until the opening of the Liverpool and Manchester Railway in 1830, when she may be considered to have achieved her fullest ascendancy; and this period of ascendancy lasted, practically, without diminution, until the consolidation of Germany in 1870 inaugurated a period of energetic industrial competition. Never before or since has the relative importance of England been so great as during this interval of about half a century.

If then, taking the coronation of Queen Victoria as a starting point, we go back through history to seek the origin of British success, we shall pass from effect to cause until we halt at the disruption of the Spanish Empire in the sixteenth century, when the sack of Antwerp drove a portion of the Flemish shipping to frequent the Thames, because of the greater security offered by an island.

England did not, however, become immediately the seat of an extended empire, or indeed a very important market, for she had not acquired a terminus in Asia nor the highways leading thereto,

nor had she developed her domestic industries upon a large scale. Her time did not come until by conquering India and Canada she established her system of commercial exchanges, and by plundering Bengal she obtained the quick capital to improve her communications and consolidate her manufactures.

Her triumph was accelerated by the adaptation of coal to smelting and the improvement of the steam engine.

Yet strong as was England's position after the administration of Chatham, one thing was lacking. She held her base in India, she could guard her shipping against the French, she had occupied Canada and opened the valley of the Mississippi, but the strip of Territory between the Atlantic and the Alleghanies still escaped her, and unless she could control the entry to the recesses of the American continent by way of such sea-ports as Boston, New York and Philadelphia, the rest would avail her but imperfectly. Compromise with her colonists as she might, unless master here, the terms on which she traded would be fixed by strangers, and the British economic system would be split in two.

Should this interpretation of the outbreak of the American Revolution seem fanciful, I can only beg you to ponder the facts for yourselves. The act of the colonists which precipitated the crisis occurred in Boston when the British tried to force their eastern trade on Massachusetts, on distasteful terms.

Charles Townshend in 1767 caused Parliament to put a duty on tea. As a means of raising a revenue the measure failed, for the province declined to buy English importations and smuggled from Holland. In consideration of entering their territory the colonists exacted that trade should be free at their ports. From the British standpoint to surrender to this demand was to surrender all; for if the colonists could dictate the terms of entry at the frontier they became, forthwith, a foreign and competing nation.

By 1770 the East India Company already suffered from stoppage of the usual vent, tea collected in their warehouses, and to protect stockholders, and at the same time placate Americans by offering them a bargain, Parliament substituted for the duty of a shilling a pound theretofore collected upon importation into England, a duty of three pence to be collected in America. You know the rest; the citizens of Boston sacked the tea-ships, rather than permit their ports to be used contrary to their wish.

No issue could be more clearly joined, and the controversy

went to the root of modern international competition, for on it turned the unity or the disruption of the economic system then beginning to centre in London. The defeat was decisive. England never could construct a dominating empire like that of Rome, and the fatal effect on that kingdom of a consequent dislocation of exchanges is becoming more evident with each passing year. Mr. Chamberlain now confronts the difficulty. He contemplates an empire without a sovereign, or an organism which cannot coerce its members. Such empires are, in reality, leagues like our Confederation, and have seldom proved more than a shadow in the face of opposition. America has been able to develop independently of, and in competition with, the parent. Canada and Australia will doubtless do the same.

I wish to emphasize the fact that England failed in our Revolutionary War chiefly because of the imperfect training of her military and official class. They had not studied in advance the problems to be solved, and were neither prepared to overcome resistance, nor to compromise. They acted from instinct, obeying from day to day the pressure which impelled them along the path of least resistance, the greatest resistance being always offered by their own incapacity to master the relations of cause and effect with which they had to deal. The superiority of such administrators as Alexander and Caesar lay in the possession of this quality. I apprehend that our chief danger in the future may be an inheritance of this characteristic. We are naturally a race of gamblers, who trust to chance; and it is this gambling tendency which makes preparation for war unpopular. War is costly and painful to contemplate; therefore the temptation is to ignore the teachings of the past, and erect the theory that mankind will eventually learn to live in peace into a moral dogma. Meanwhile the experience of many thousand years proves that under certain conditions war is inevitable. Those conditions consist in a certain intensity of economic competition.

For example, as between England and her colonies a divergence of interest existed which was fundamental. A prize of immeasurable value lay at stake which both parties coveted too intensely to yield, except in the last extremity. After the destruction of the tea, Great Britain had to apply coercion or abandon the attempt to consolidate an empire, with all the advantages which such a consolidation implied. Thereupon she did what every

other people has done under like circumstances, she tried force. Furthermore the measures adopted were not ill-conceived in themselves; the failure came from administrative impotence.

Five acts were passed to pacify Massachusetts. The first closed Boston as a port of entry; the second annulled the charter; the third provided for the trial in England of soldiers accused of violence toward citizens; the fourth regulated the quartering of troops upon the inhabitants, and the fifth extended the boundaries of Canada to the Ohio. Thus the colonies were isolated; Great Britain held the sea on the east and the valley of the Saint Lawrence on the north, while to the west she extended the jurisdiction of an absolute viceroy over the whole region won from France. You see the strength of the position which England sought to win, and that the prize was worth a contest. Had she conquered the colonists who inhabited the belt between the ocean and the Ohio Valley, she would have held her base in Asia, she would have possessed an unrivalled industrial plant at home, and she would have opened a practically exhaustless vent for her manufactures and a storehouse of raw material in America. In the case of victory, she would not have had to fear the protective American legislation, which has built up American competition. She would have regulated her exchanges with this continent to suit herself. So far as we can judge, something approaching an equilibrium might have been established, and under such conditions America might have remained an agricultural community, and Great Britain might have served as the universal market down to the present day. Viewed thus it is apparent that the stake for which England played in 1775 was little less than universal empire; and this brings us to the consideration of what England was at the outbreak of the Revolutionary War; what the so-called "Industrial Revolution" meant; and why that phenomenon should have first tended to hasten the American Revolution, and afterward should have precipitated a social convulsion in France.

I have said that the "Industrial Revolution" began with the completion of the Bridgewater Canal to Manchester, because the creation of the canal system was the basis of the English industrial development of the last decades of the eighteenth century. Previous to 1760 the roads of England were so bad as to make transportation of bulky merchandise by land impossible upon a large scale. The cost was prohibitive. From London

to Birmingham the charge ran from 25 to 35 dollars a ton, and from London to Exeter 60 dollars. In winter, traffic was impossible. In 1607 Camden declared that he approached the Lancashire people with dread, and when he started to make his survey commended himself to the divine mercy. Matters had not changed very much a hundred years later, for the Rev. Mr. Brome, who travelled for three years throughout the islands, and saw many wonderful things, wintered like an Arctic explorer when wet weather set in. Carriers used pack-horses, as the roads were generally too deep for wagons. From Manchester in 1757, there was but one coach to London every second day, and it took four days and a half to do the 130 miles.

Under such conditions, in winter, towns were isolated, and often suffered from famine. Sometimes Manchester had bread riots, one of which called the Shude Hill fight was rather serious and was long remembered. It cost 40s. a ton to convey goods from Manchester to Liverpool by road, and 12s. by river; but by river there was danger of damage by the way.

Many years later Arthur Young travelled through Lancashire, and thus described the highway between Wigan and Preston, the great road north from Liverpool and Manchester to Carlisle and Glasgow: "I know not, in the whole range of language, terms sufficiently expressive to describe this infernal road. * * * Let me most seriously caution all travellers, who may accidentally propose to travel this terrible country, to avoid it as they would the devil; for a thousand to one they break their necks or their limbs by overthrows or breakings-down. They will here meet with ruts, which I actually measured four feet deep, and floating with mud only from a wet summer; what, therefore, must it be after a winter? The only mending it in places receives is tumbling in some loose stones, which serve no other purpose but jolting a carriage in the most intolerable manner. These are not opinions, but facts; for I actually passed three carts broken down in these eighteen miles of execrable memory." *

While communication with the interior remained thus imperfect, Liverpool could not grow. Bristol surpassed it in importance. No stage-coach ran between Liverpool and Manchester until 1767, and then only thrice weekly. It took from early morn-

* A Six Months' Tour through the North of England, IV, 580.

ing until late at night to accomplish the 30 miles. Beyond Manchester the country grew worse, and the moors between Lancashire and Yorkshire were little better than a wilderness. In 1724 Manchester had a population of 2400 families or about 12,000 inhabitants. In 1757 Manchester and Salford together had but 20,000; so that the growth in a generation had been slow. Indeed a dense population could not have been supported.

In 1760 in all departments of applied science England lagged behind the continent. When the Industrial Revolution began Holland had long since finished her extensive net-work of inland navigation, and Arthur Young as late as 1787 wrote thus of French roads as compared with the English: "The roads here are stupendous works. * * * These ways are superb even to a folly. Enormous sums must have been spent to level even gentle slopes. * * * There is a bridge of a single arch, and a causeway to it, truly magnificent; we have not an idea of what such a road is in England." *

Technical education was neglected; so much so that the early engineers were usually illiterate. John Metcalf, the first great road maker, started life as a blind fiddler. Brindley who built the Bridgewater Canals on a salary of three shillings and six pence a day, was a millwright's apprentice who could hardly read, and never spelled well enough to make his notes fully intelligible to others. George Stevenson began as a day-laborer in the mines.

Notwithstanding these drawbacks, no sooner had the eastern trade been centralized in London by means of Clive's and Wolfe's victories, and an adequate capital provided for construction by the plunder of Bengal, than England began to develop with an energy which, allowance being made for a difference of bulk, at least equalled the recent growth of the United States.

Industrial England is small and compact. Industrial America is vast. If Manchester be taken as the centre, industrial England will be found to lie within a radius of little more than 100 miles, no important point being much above 50 miles from tidewater. The region is full of coal and iron, often lying near the coast which abounds with harbors. The rivers are small, numerous, and adapted to feed inland navigation; there are no formidable mountains.

* Young's Travels in France, Vol. I, p. 44.

Manchester is distant but thirty-two miles from Liverpool, the intervening country being so easy that, with land damages included, the Duke of Bridgewater built the canal between the two cities and his own coal mines, for $1,100,000. Birmingham, which may, perhaps, be considered as the heart of British industry and which lies near the middle of the kingdom, is equally well situated in regard to transportation. 112 miles by rail from London, it is nearly equidistant from Liverpool and Bristol, and 78 miles from the former. Previous to the opening of the canals it has cost 5 pounds sterling a ton to convey freight from Liverpool to Birmingham; the canal reduced the rate to 1 pound 10 shillings. Short distances made the outlay for construction small. The Grand Trunk system of canals which connected Birmingham with the Mersey, the Severn, and the Thames, measured only 250 miles, and was completed in 1777, while the 3100 miles of inland navigation which, at the close of the century, intersected the United Kingdom cost 50,000,000 pounds. By 1794 there was no "place in England, south of Durham, more than fifteen miles from water communication; and most of the large towns, especially in the manufacturing districts, were directly accommodated with the means of easy transport of their goods to the principal markets." * The hills between Lancaster and Yorkshire were pierced by three navigable canals.

The effect was prodigious. Manchester's population advanced from 20,000 in 1757, to 41,000 in 1774, and 84,000 in 1801; while Liverpool's shipping which had been estimated at 8619 tons in 1701, exceeded 450,000 in 1800.

The sequence of cause and effect seems complete. The competition between England and France for the eastern trade generated the Seven Years War; by 1760 the Seven Years War had given India and Canada to England, and with India the treasure of Bengal. Then simultaneously followed the industrial revolution in Great Britain, and the attempt to reorganize America, as the western terminus of the new economic system, on such a basis as to form a cohesive whole. The first boat-load of coal sailed over the Barton viaduct to Manchester on July 17, 1761. On February 10, 1763, the treaty of Paris was signed, which established the naval and colonial superiority of Great Britain.

* Lives of Engineers, Smiles, I, 464.

On March 22, 1765, the Royal Assent was given to the Stamp Act. On the last day of 1772 the locks of Runcorn were opened which completed the Liverpool and Manchester Canal. On December 16, 1773, the people of Boston sacked the tea-ships. In 1774 Watt and Bolton went into partnership to manufacture the steam engine, and on March 18 of the same year, the Boston Port Bill was brought into the House of Commons. The following May, General Gage took command of Boston.

I conceive that this chronological table alone enables us to estimate roughly the effect which the economic consolidation of England produced upon the relations between the central market of the new system and its American terminus. It yet remains to consider the impact of the victorious organism upon its defeated rival on the continent of Europe.

England had consolidated rapidly after the Cromwellian Wars, because during those wars the superiority of the attack over the defense had been established. Thereafter no local power remained which could defy the central energy. In France in 1770, feudalism still lingered. Feudalism was the legal name for decentralization, because feudal law expressed the fact that the defense in war predominated over the attack. A country is decentralized when the provinces are independent, or quasi-independent; and a province is independent which cannot be coerced.

Thus under the Confederation, America was decentralized because the central power could not coerce the members; nor was the superiority of the attack over the defense demonstrated until Lee surrendered at Appomattox. In France in the eleventh century decentralization reached an extreme. Most barons could build castles formidable even to a king, and such barons became quasi-independent princes who exercised all the functions of sovereignty within a restricted territory. The great frontier fortresses were gigantic and almost impregnable. Accordingly the monarchy never thoroughly reduced the chief provinces to subordination, and cities in France retained a power of oppressing the adjacent country which would have been impossible in England. The privileges of Bordeaux were not exceptional and yet Bordeaux laid waste a considerable district by closing the avenue of the Garonne to the export of wines which competed with her own. "Who would dare to believe," said the economist Goyon de la Plombanie of Perigord, "that the council of our kings, when

it accorded this abusive privilege to the city of Bordeaux, even suspected that this singular right would occasion a general devastation. * * * What sight is more afflicting than to contemplate a district fifty leagues in length, by twenty, at least in breadth, almost altogether uncultivated and abandoned.*

Under the disadvantages of decentralization, France had long before proved unable to contend commercially with Holland; and Colbert had supported Louvois in making war in 1672 against the United Provinces because, having failed to overcome the opposition to a uniform administration at home, he saw no remedy but to crush his rival by force. Colbert estimated that out of 20,000 ships in the world, the Dutch owned 15,000 or 16,000, and these he proposed, by conquering Holland, to drive from the sea. He failed, and after his failure France declined apace; nevertheless as long as native industries could live, the catastrophe was postponed. The crisis came when, by the consolidation of her society, Great Britain succeeded in throwing masses of manufactured material on the international market, at prices with which the French could not cope. The effect was precisely similar to the establishment of a modern department store among old-fashioned retail tradesmen. It was bankruptcy. Movement in France nearly ceased, and actual starvation set in, because the people could neither sell their agricultural products nor their manufactures. Arthur Young in 1787, although he praised the roads in France, observed that no one used them: "The traffic of the way, however, demands no such exertions; one-third of the breadth is beaten, one-third rough, and one-third covered with weeds. In 36 miles, I have met one cabriolet, half a dozen carts, and some old women with asses. For what all this waste of treasure? * * * Women without stockings, and many without shoes; but if their feet are poorly clad, they have a superb consolation in walking upon magnificent causeways; the new road is fifty feet wide, and fifty more digged away or destroyed to make it."

Much has been written touching the distress in France before the Revolution and, I am inclined to believe, without exaggeration. Only last year M. Marcel Marion published an excellent little treatise upon the condition of the rural classes in the Bor-

*État des Classes Rurales au XVIII^e Siècle dans la Généralité de Bordeaux, Marion, 100, 101.

deaux district during the last half of the eighteenth century. I give you but one extract, by no means the most striking: "It is perhaps in the year 1789 itself that the distress attains its highest point. 'The misery augments,' writes, on May 2, the delegate of Saint Foy; '* * * resources are exhausted, the people have no credit, and all that could have served as nourishment for the poor, such as potatoes, cabbages, turnips, herbs, is entirely destroyed by the winter frosts.'

"At Soulac, of 100 families, 90 are in extreme indigence; at Eyzines, many sleep without eating; at Cerons, the day laborer is reduced, since two months, to take but half his usual nourishment, and this only on condition that his wife and children take but one third of theirs. (Reponses des curés)—it seems, that Linguet did not exaggerate when he declared that the lot of American slaves was better than that of French peasants." *

England undersold the continent because England could deal more rapidly with larger masses, and England succeeded in so doing, because by the help of her conquests and her minerals she reached a higher degree of consolidation sooner than any continental nation; for in decentralization Germany surpassed France. The effect was a convulsion, both internal and external. France, driven to the wall, had to consolidate her society with rapidity, and, being unable by this means alone to attain to immediate relief, she attacked her adversary.

The Liverpool and Manchester Canal and the introduction of the steam engine were contemporaneous events, happening in 1773 and 1774. France thought at first to disable her enemy and strengthen herself by aiding the American revolt. Failing here, the Revolution of 1789 became inevitable, and the Napoleonic wars resulted from the Revolution. Time fails me to examine the policy of Napoleon, nor is it necessary for the present purpose. What concerns us, immediately, is the application of the history of this last economic consolidation to our own circumstances.

If the inferences drawn from the facts adduced are well founded, momentous events followed upon the conquest of the eastern trade by Great Britain, and upon the industrial develop-

* État des classes Rurales au XVIII siècle dans la Généralité de Bordeaux, 119, 120.

ment of a narrow region lying mainly in the northern counties of England and the south of Scotland. In its largest sense this industrial district, allowing it to extend in length from London to Glasgow, and in breadth from London to Swansea, cannot be reckoned as more than about 400 miles by 160. If we compare these dimensions with ours which stretch from Duluth to New York, and from Chicago to Birmingham, we perceive at once the cause of our slower development, and the greater energy which has been demanded to produce a given result. Assuming, however, that the United States has relatively about reached the point occupied by England toward the year 1789, we can hardly expect that the effect of a perfected consolidation, should it be accomplished, will be proportionately less than were the effects of the consolidation of Great Britain a century and a quarter ago.

If I am right in my theory that the energy developed in social consolidation is proportionate to the mass to be consolidated, then the energy now being generated in America should be in the ratio of about four or five to one, as compared with the energy of England. Probably such an estimate would be excessive, but in any case our energy is evidently the greater of the two. You have only to measure our transportation by English transportation, or our building by English building, to be convinced.

I take the single building to be the unite of any civilization, and consolidation, therefore, may pretty accurately be tested by the cnaracter of architecture. Within the past few years, as consolidation has acquired intensity in America, the steel cage has appeared, because the steel cage, theoretically, admits of a higher degree of concentration, and, therefore, of economy, than any known type of construction. The energy which, a generation ago, was diffused over a street, is now concentrated under a single roof; as, at the beginning of the Industrial Revolution, the energy which had been diffused through a hundred separate family dwellings became concentrated, in a single factory.

The inference is that within these last few years civilization has entered on a new phase, much as it entered on a new phase when it passed from the pack-horse to the canal-boat subsequent to 1776.

If the building is the foundation on which society rests, then, in the matter of its foundation, the world has passed from such substances as wood, brick and stone, the material used by all antecedent generations, to steel; and by so doing has altered the con-

ditions of competition. Cheap ore which is found only occasionally must henceforth be, to civilized races, as prime a necessity as the brick or stone which is found universally.

Here lies the crux of the future; for I will, if you will permit me, assume for the moment, that we shall succeed in organizing and maintaining a civilization whose economy of operation shall be proportionate to the concentration of the steel cage. Our success will force all competing nations to adopt our standard, as surely as England forced the continent to adopt her standard when she accelerated movement in the eighteenth century. But you can estimate as well as I, what would be the effect on the iron trade were all Europe to attempt reconstruction on the scale on which we have been rebuilding our cities and our railways within the last ten years.

We are in good times producing pig iron at the rate of roughly about 20,000,000 tons annually, and, supposing the country to continue its growth, we shall be producing between forty and fifty million tons within twenty years; nor does the demand appear to be limited by anything but the money available to be converted from quick into fixed capital. No one can foretell how long our mines will endure such consumption before the price of ore rises; and a rising price is tantamount to exhaustion in the face of a cheap foreign supply. I apprehend, however, that Europe cannot undertake reconstruction at present, because Europe has not the steel available, at the requisite price. Yet if we succeed, Europe cannot stand still. To do so is to succumb. We appear, therefore, to be confronted by an alternative. Either within the next generation America herself will be driven to seek supplies of ore beyond her borders, or if not, her very success in production will constrain competing nations to do so.

At present, so far as we know, Northern China offers the most abundant and the cheapest supply of minerals, combined with the most advantageous labor, and accordingly Northern China promises to be the terminus of modern trade-routes, in that imperative sense which implies that without its resources modern competition cannot be sustained.

I beg you to reflect on how this contingency which is already upon us, must affect the United States. Admitting that Northern China should be developed by some energetic and administrative race, the product of China would undersell the American

product in the Pacific; for that we must be prepared. The accessibility of the mines to the coast; the abundance of iron and flux and coal, and the cost of labor combine to make such a result probable. Furthermore, you are now engaged in a highly revolutionary and speculative enterprise.

The Government is pledged to construct a canal across the Isthmus, a work which sooner or later promises to deflect trade-routes and thus remodel empires. At the outset I need not point out to you how commanding a position England holds at Kingston, relatively to any such highway.

Leaving aside, however, for the moment, questions referring to particular competitors, and recurring to general principles, I affirm that no lesson is more enforced by history than that which teaches us that, he who holds the terminus and the market will one day also hold the connecting road. I need not go back to the middle ages; I will take a modern instance. The French built the Suez Canal, but the English soon acquired control thereof. Apply this precedent to ourselves; and it is the more forcible, since we have to face a sharper competition, and we are inferior at sea to any probable coalition which might be made against us. We lie between two adversaries, England and the Continent, both of whom we menace, and either of whom would gladly destroy us, were the nearer enemy eliminated.

Of these two adversaries the one most actively hostile is, at present, the great continental economic system which connects China, overland, with the North Sea. The heart of this system is at Berlin, the chief western port is Hamburg, and the arteries of communication branch out north to Petersburg; east to Moscow, Lake Baikal, Port Arthur and Pekin, south-east by the Volga to the Caspian, Central Asia, and the Persian Gulf, and south to Breslau, Kief, Odessa and the Black Sea. Over some of these roads from the dawn of time, commerce has flowed between the East and West, and the richest provinces of the world lapsed into deserts because rates for freight were one day made more cheaply by ships sailing round Ceylon, than by caravans crossing the Pamirs or the Hindoo Kush.

For several centuries, as the markets upon the North Sea gradually acquired ascendancy, Russia tended to consolidate, and as it consolidated to stretch westward toward the ports which gave its traffic vent. Parts of Sweden, Poland, Turkey and other states

were absorbed. Toward the middle of the nineteenth century this movement acquired an energy which caused the nations of the West to coalesce in opposition and thus precipitated the Crimean War. That war decided the destiny of Russia. The siege of Sebastopol practically coincided with our discovery of gold in California, with the opening of Japan, and with the quickening of movement on the Pacific. From the peace of 1856 Russia reversed her attitude and followed a path of expansion eastward which offered larger possibilities and less resistance than that which led to the North Sea and the Mediterranean. She now confronts the United States and Japan more decidedly than she confronts any European power. There can be no doubt that the phenomena developed by the United States and Russia not only have a relation to each other, but that the two civilizations must contend in the future for domination in eastern waters. But if Russia has found an outlet overland toward China and the Yellow Sea, Germany has been less lucky. During the middle ages the Germans fought persistently to penetrate the wastes beyond the Niemen, but, on the whole, since Ivan the Terrible began the consolidation of modern Russia, the Germans have lost ground. On the other hand the continental growth of the overland trade has built up Leipsic, Berlin, and the Kingdom of Prussia which forms the core of the modern empire, and this northern consolidation promises to spread along the shore of the North Sea as far as Antwerp. To the south, it may attract the German provinces of Austria. There, however, expansion seems destined to stop, and yet unless the Germans can find an outlet for their surplus energy and add both to their territory which yields a revenue and to their mineral resources, they may be unable to maintain their relative position toward countries like the United States, Russia and England, which have superior advantages. The obvious method to obtain relief is to establish a terminus beyond the ocean, and for the Germans, South America is the only region still substantially empty, rich, undefended, and accessible, which remains open. Hence the desire of the German Emperor to obtain a foothold therein; since all intelligent Germans know that the resources of their country, which were never bountiful, have been utilized to the utmost, and that should Germany be confined to the continent of Europe she may, like Japan, if shut in her islands by Russia, run the risk of suffocation. Under such conditions

we shall be justified in inferring that Germany will do her best to annihilate the power which opposes her.

Thus we have two great nations, Russia and Germany, which together form a mighty economic system, stimulated by the same pressure, expanding in opposite directions, from a fixed base, one end stretching toward the east, the other toward the west; and the channel by which these ends must communicate is a canal across the American Isthmus. The necessity for communication is obvious; the success of such a development must depend on the abundance of the supply of minerals, especially of steel, and these minerals will, presumably, be best obtained in China. Furthermore, no insuperable difficulties seem to beset the industrial organization of Shansi and Honan, provided the provinces can be conquered and administered. The Russians are well situated to invade, while the Germans have both the capital and the talent for administration. Already the economic union of Germany and Russia is advanced; the Germans are steadily absorbing more and more of the Russian industry and commerce, and German is becoming the language of mercantile affairs in the chief Russian cities.

I need not dwell on the possibilities suggested by these speculations. It suffices to say that the first step in such a social revolution would be the establishment of a new trade-route between Europe and China, with a central vent in South America. Under these conditions the United States would be thrown into eccentricity. Moreover, however this may be, I do not conceive that the initial step of determining the destiny of South America can be indefinitely postponed. The United States must either act herself or permit others to act, or else she must defeat in battle invasions of the country. To meet any of these contingencies she should be armed, and not armed with a puny force, but as a power of the first magnitude. Judging from the past the men who, in the end, will prevail in South America, will be those who can control the cheapest steel, and the power who can do this may probably be the one which commands the minerals and the labor of China.

On the other hand if we suppose a contest between England, Russia and Germany in the East, in which England should be the victor, the ultimate result, so far as we are concerned, would not perhaps be much more favorable. We should be injured because

England could hardly prevail without gaining such a superiority over her antagonist as to leave her practically alone, confronting us, and unable to escape from a struggle for supremacy, very much as Rome and Carthage struggled for supremacy in ancient times. It is the old question of a base, a central market and a vent. I will illustrate what I have to say by the agitation which is now going on for a consolidation of the British empire.

Examine the social condition of England and you will find that all her present difficulties flow directly from her defeats in 1780 and in 1814, for she then lost the Mississippi valley as a terminus. England is pinched since she has to buy raw materials and food, and cannot sell her manufactured product at a price high enough to balance the account, because of competition and hostile tariffs. Could she still command the interior of this continent she would not have to contend with adverse legislation or centralized competition on a formidable scale.

For many years Englishmen seemed incapable of grasping the situation, but since the Boer War their predicament has been forced upon their attention, and now Mr. Chamberlain bases his proposed policy upon the postulate that the British empire must dissolve unless greater cohesion can be given to the parts. To the unprejudiced observer it has long seemed probable that such a catastrophe might happen should the centre of international exchanges become permanently established in New York, because, in that case, trade-routes would recentralize, and the countries ranged along these routes would gravitate toward a western market. In that event England would sink into the position of a quasi province of America, and it is to prevent such an eventuality that Mr. Chamberlain reccommends a discriminating tax on food. Chamberlain proposes ultimately to make the British economic system self-supporting, as it would have been had England prevailed in our Revolutionary War. I doubt not that the initial steps of this enterprise would be taken without hostile intent toward this country; but such a path leads far. You cannot have a self-supporting empire without a base, a central market and a terminus. The only adequate terminus for the sale of commodities which now presents itself to England is North and South America, and the only base whence adequate supplies of minerals can be drawn, at a remunerative price, seems to be China.

Suppose Great Britain to occupy and develop Northern China

as she has developed South Africa, she would have her base and her raw and manufactured material, and then the question would arise as to South America, precisely as it would arise with Germany, or with any country having a mass of cheap steel seeking a vent, together with a surplus population. We should be her only opponent. With us destroyed she would enjoy universal empire like Rome. I apprehend that, since the world began, such conditions have always bred war, and in this case supremacy might hinge on a naval battle. Should we lose the canal we should be enveloped. Please observe, I express no opinion as to the value of Mr. Chamberlain's proposition, as to the energy of Great Britain, or as to the possibility of winning a decisive victory in the East. All I wish to point out is the danger for us of the distinct predominance of either one of the two competitors whose quarrels have been our safety for nearly two hundred years.

On questions so vast, involving causes and effects so complex, the conclusions of any individual must be fallacious; a valuable approximation can only be reached as the result of a consensus of opinion of such a body of men as you, who have both the ability and the means to study. Were I to hazard a conjecture, I should surmise that Englishmen have thought out the problems before them hardly more effectually than they resolved the problems of 1774. In this way they are unlike the Germans who labor intensely. And yet, with all that intelligence and patience can do, the difficulties which confront Germany and Russia are great; I had almost said insuperable. We hold at present the position of advantage. Therefore my inference is clear. We enjoy the good fortune of standing between two economic systems which counterbalance each other, and which will, in the end, exhaust each other if we so handle our opportunities as to prevent either from obtaining a decisive advantage. Accordingly our aim is simple. We have only to keep things as they are as long as possible, and when a determination of the struggle can no longer be postponed, we should be ready to deal with the prize as we dealt with the valley of the Mississippi, for which France and England fought so long. Such has been our policy regarding South America during more than two generations; a policy which we have been able to maintain without war, and with little risk, because we have been resolute, and have understood our own interest. I appre-

hend that our government could take no wiser course than to extend the principle enunciated by President Monroe over the mineral region of Northern China. Of this we may rest assured; while our competitors can be kept asunder we can rule; our hour of peril will come when by war or otherwise they consolidate and the consolidation turns on us. Then China will be organized and opened. It matters for us little by whom.

Hitherto I have proceeded upon the assumption that we are domestically so well organized that we shall succeed in accomplishing our destiny (unless we meet defeat from a foreign enemy), by cheapening our civilization through consolidation. Yet I must admit that upon this point I harbor doubts. I am clear that the seat of empire is in movement, but I am not so sure that we shall succeed in anchoring it within our borders.

Touching the first point I think the evidence decisive. The conditions which exist in England and Russia are precisely those which would be anticipated were trade recentralizing. They recall the conditions which prevailed in France and Germany a century and a quarter ago. But the changes which followed upon the Industrial Revolution of 1761 did not stop at France and Germany, they reached Great Britain as well; and the United Kingdom of 1840 hardly resembled the country governed by Lord North more closely than the France of Bonaparte resembled the old regime. By parity of reasoning if the changes in social equilibrium which are now in progress tend to disintegrate institutions elsewhere, they can hardly fail to revolutionize those existing here.

Decentralization is always relatively cumbersome and costly; and our system inherited from another age is a system of decentralization. I wish to make my meaning clear. I am expressing no preference; I am trying to apply past experience to present affairs. I will illustrate my theory by the condition of our industries.

Some years ago when Americans first began to attack the problems of industrial consolidation upon a large scale, great advantages were anticipated from merger not only because of economics in wages and rent, but because of the cheapness of dealing in bulk. Every one knows that better rates can be made by the car-load than by the ton, and by the train-load than by the car. I fancy it will not be denied that these expectations have been but imperfectly realized, and that the cost of operating the average consolidation

does not show the expected saving over the cost of operating the component companies separately. I might cite many examples, but one will suffice. I will take the United States Steel. The history of this corporation seems to show that the point has been nearly reached when, with men trained as are ours, the mass consolidated transcends administrative powers, and accordingly waste balance savings.

That the President of the United States Steel Company was unequal to his task is obvious, and requires no comment, save in so far as his failure illustrates a principle. He is, I am disposed to think, a type of a class.

For many years we have addressed ourselves to creating specialists, and we have outgrown the specialist. No man can now be successful in the conduct of modern enterprises who cannot generalize, and generalize upon broad foundations. The president of the Steel Trust was a typical specialist, and, being a specialist, he could not grasp general conditions. He broke down. As the head of a department he would have succeeded.

Society is a mechanism which obeys mechanical laws, and changes in administrative methods must coincide with development. Suppose we grow in the next three generations with an energy only equal to the energy developed by England during the last three, and we have this result. In 1801 the population of London, in round numbers, was a million. In 1901 that of the Metropolitan District exceeded 6,500,000. If New York and Chicago expand only in the same ratio they will contain by 2001 between 15,000,000 and 25,000,000 inhabitants. I incline to believe that our society is no more competent to deal with such masses than English society of the eighteenth century would have been to deal with what now exists. English life and English education have been completely changed in a century. For these reasons, if we are to succeed in the gigantic task to which we must address ourselves, I am convinced that we must accept radical innovations, and we must be provided with men of the highest administrative capacity. If you look about you I conceive that you will draw the conclusion which I have drawn, that our failures have come from imperfect generalizations and our successes from our superiority in administrative methods. If you examine the cause of the defeat of our acutest men of business last year in the coal strike, you will see in the end that they miscalculated the forces to which they

were opposed, because they were too highly specialized in a particular direction. Conversely our engineers in South Africa have distanced competitors, not because Americans are liked by the English, but because an American engineer is also a chemist and a mechanic, and can reduce his refractory ores as well as mine them. So with our railroads, we have bred a type of man distinct from the men who manage railroads abroad. Hence success. Here it seems to me we reach the point where we can measure the responsibility of the Naval Staff of the United States. Foreign affairs are but the reflex of domestic conditions. The two are halves of a whole, they cannot be dissociated; and incapacity to appreciate our domestic phenomena and provide for their effect abroad may be fatal. It may be fatal, as the battle of Trafalgar was fatal to France. But if war is the fiercest form of economic competition, it is an effect of causes which may be recognized beforehand, as certainly as the approach of rate-cutting by railways.

If you will look back through history you will perceive the part played by the military mind in the adjustment of human society. The reason is that the military mind when not narrowed to a specialty, but broadened by a varied training, has proved the most powerful of administrative agents.

Alexander was a military genius, but he was something more. He was a great economist. Other Greeks might have captured Tyre, but Alexander's capital conception was not so much the attack on a stronghold, as the relation of eastern and western exchanges. He comprehended the value of the direct route to India. He founded Alexandria, threw Phoenicia and Babylon into eccentricity, and thereby changed the equilibrium of the world.

So with Caesar. Caesar did not establish the Roman Empire through the victory of Pharsalia, for no amount of victories would alone have created a stable equilibrium between the East and West. Caesar's power lay in his grasp of the fact that the civilization in which he lived could not consolidate until it had broadened its base by absorbing Gaul. Study the map and the history for yourselves, and the more you ponder on Caesar's voluntary exile for years before he made his final attack upon Rome, the more you will be penetrated with admiration for that far-reaching intellect which seized upon the correlation of the parts of the

society which he was to regenerate, when his generalizations would have seemed insanity to his contemporaries.

Permit me a last example. No platitude is more popular than denunciation of the conqueror and the military despot, and none is flimsier. The soldier does not create a despotism; despotism is the fruit of a social condition. The soldier when he organizes a society upon a despotic basis conforms to the conditions before him; but if these are unfavorable to despotism, and he proposes to succeed, he establishes a republic or some other kind of government. Government is a means to an end, and that end is the preservation of property and order.

Study the career of Washington. I take it the least part of our nation's debt to Washington is due for services in the field; his chief work was organization and administration. Certainly Washington was no despot, and yet Washington would hardly have hesitated to use force to prevent the Confederation from lapsing into the condition of a South American republic, had force been needful to attain such an end. Washington was a Republican, but he was first of all a practical man, and an administrator. Washington, like Alexander, or Caesar, or Cromwell, understood the society in which he lived and adapted himself thereto. That he could do this proved him to be no visionary but truly great, as his predecessors had been great before him. His sagacity contributed more than any other single factor to the adoption of the constitution, and through the adoption of the constitution to the construction of the foundation of a great administrative system.

That system we and our descendants must complete, and, unless I greatly err, in the process of construction the Naval Staff of the United States must face responsibilities more serious than any it has heretofore borne. Among these must stand in the front rank the adjustment of military force to the exigencies of economic competition.

I have given you my reasons for supposing that we are approaching serious changes. Probably we are already in an era of transition. When the critical moment arrives the revolution may pass in tranquillity as when Washington became president; or it may be a convulsion like the terror of 1793 in France. How it is precipitated often depends upon the fortune of war. A military catastrophe sometimes works as did the overthrow of France in 1870, which was followed by the commune of Paris; and even

supposing such a misfortune to be averted a reverse may be decisive of a nation's destiny. Defeat often comes from ignorance of the nature of an emergency. I recur to the example of Great Britain. I am convinced that, from an economic standpoint, Charles Townshend's policy was sound. The vice of the undertaking lay in the execution. Had Lord North been endowed with Chatham's genius, had he chosen his opportunity and his issue with sagacity, had he selected officers like Marlborough or even Wellington, the result might have been different. The British suffered through the incapacity and ignorance of the official class. In the first place no competent minister would have engaged in a war in America without first having assured himself of the neutrality of France. In the second place no competent officers would have countenanced campaigns such as those actually undertaken. Or to put the proposition in other words, the staff should have been in a position to advise the government that they would not be answerable for consequences, unless the neutrality of France were guaranteed, and a force put at their disposal strong enough to crush the revolt forthwith.

The Duke of Wellington acted thus in 1814. When consulted by Lord Liverpool, Wellington wrote: "That which appears to me to be wanting in America is * * * a naval superiority on the Lakes." "In regard to your present negotiations, I confess that I think you have no right, from the state of the war, to demand any concession of territory from America." That ended the discussion within the cabinet, and the treaty of Ghent was signed.

Wellington spoke with authority because he was something beside a soldier. He was a man of the world. A man used to diplomacy as well as to war. In short, a man of the class of Caesar, of Cromwell and of Washington. Our danger is in the character of our education which makes men too special. Civilians are apt to consider officers as men whose opinion is of value only within their own department, largely because officers are prone to confine their attention somewhat exclusively to military affairs.

Such tendencies, I conceive, if fostered, will be a menace in the future, for time presses and we must not only mature a policy, but prepare for action. In ten years the canal will be finished and then, if I am right in my inferences, trade-routes will begin to change, and with a change in trade-routes will come a recentrali-

zation of civilization. New strategic positions will acquire importance and new regions will be developed. Reflect on what has followed upon the experiment at Suez, and Suez involved no revolution so radical as that contemplated by piercing Panama and throwing South America into the arena, as Africa has been thrown since 1870.

To me, as I have said, the preliminary step seems clear. Self-preservation would prompt me to defend the integrity of Korea and the Chinese Empire, if necessary, by arms, since by so doing we should be sure of allies, and should be certain to divide our competitors more radically than they are divided now. I do not apprehend, however, that we should be driven to war. The mere certainty that we should be ready to resist would work in China as it has worked nearer home. We, with our allies, would be too strong to be defied.

Yet assuming so much to be conceded, the expedient is only temporary, we have attained to nothing permanent.

We have before us problems whose magnitude cannot be exaggerated, and whose complexion changes with bewildering rapidity. If the United States is to fulfill her apparent destiny and become the converging point of trade-routes and the seat of energy and empire, our successors must not only be able to handle masses by the side of which those which now oppress us will be small, but they must have means of reaching their decisions with rapidity and precision. To that end we must have men trained as specialists, and yet capable of generalizing.

I have met officers of several foreign services, and I have concluded that ours are the most efficient for two reasons: First because they have a broader basis of instruction to start with; and second, because terms of shore duty enable them to keep abreast of the movement of their time. Yet if I may hazard such an opinion I should conjecture that the principle upon which our military education proceeds might be expanded and improved.

All naval officers must, I suppose, be seamen and strategists, but all cannot be thorough in mathematics, in mechanics, in chemistry, in metallurgy, in international law, and in the many other branches which now are included in the sphere of a naval education. He who should attempt to compass this would be superficial.

What I should imagine might be a practical solution of the difficulty would be to encourage a certain degree of specialization,

without abandoning the foundation necessary to enable every man to correlate for himself the different departments of his profession. Each student at Annapolis might be required to attain to a certain minimum in all branches, after which the time saved from certain uncongenial studies might be given to others in which he excelled. The officer might thus become a profound specialist, and yet remain an intelligent administrator.

You need scientific men in the navy, as well as practical seamen, but you also need economists and historians, for without these you will be weak in a vital point. You will lack a channel of communication with the public, and such a channel is essential both to you and to the nation. You must be able not only to formulate your conclusions, but to state the steps by which you reach them, in order that you may be able to demonstrate the necessity of the armaments you advise.

As life grows more complex men must acquire increased versatility. Think of the interval which separates you from the generation which produced Hull and Decatur, and estimate what a body of diversified intelligence a naval staff must represent before this century shall be old. More especially is this true in America, where our public is both vast and intensely occupied with private business. We have no permanent section of the population whose birth naturally leads them to participate in public affairs. Neither have we a trained corps of experts. Theoretically the relations of a nation with foreign countries should appertain to the domain of diplomacy, but practically modern life is too fast for old methods. Even supposing a trained service to exist, as abroad, it answers little purpose now, so far as leading opinion goes. The tendency is for men to enter the diplomatic service young, grow old amid narrow circles in foreign capitals, and lose connection with the great currents of competition which agitate the world of practical affairs.

Officers of our navy travel throughout the world, they are stationed abroad to observe other civilizations, they return home at regular intervals and there they are apt to be thrown into active relations with many of the great industries of the country, above all they are always under the responsibility of being answerable with their lives for inaccuracies in their work. Add to this that they are a self-perpetuating corporation, and not only practically choose their successors, but educate them from boyhood.

Such a corps of men, with such advantages, who would give a portion of their energy to a study of the economic side of war, on the principle that war is a form of competition in the struggle for survival among nations, could hardly fail in time to gain the confidence of the public. They would do so because they would be competent, and because their judgment would be impartial and not warped from year to year by impending elections. Their doctrines would finally be crystallized and become the common property of each successive administration and congress, very much as the Monroe Doctrine would be supported as loyally by a Democratic as by a Republican cabinet.

The Naval Staff would speak with authority, as any high official speaks, and they would always represent the interests of the whole nation apart from domestic politics. No private individual could ever have such weight, and few public men have either the taste or the time to be thorough in abstract matters which require severe and sustained application; even when such men are to be found, they stand alone. They do not form a school whose traditions pass from generation to generation. I make no apology for these suggestions, for, as a citizen, I feel that the efficiency of the navy touches my personal safety. My country may at any hour be involved in war against serious odds, and her chance of victory will then be proportionate to her preparation, and her preparation to the intelligence with which she has been taught to estimate the possibilities of the future. In my judgment, national efficiency rests on national intelligence, and my conviction is that the American people will never act intelligently in the matter of self-defense until they have trained their naval staff to be their guide in regard to the probabilities of war, and then have learned to trust them.

I do not insult you by intimating that your country does not have the most perfect confidence in you where active hostilities are concerned. I know not what would become of us, could we suppose that an emergency could arise in which our navy would not do its duty; but we need something more than this, for the most devoted and the ablest men can only accomplish that which they have the means to do. We must give you the means to fight our battles for us, if we are to look to you for victory. The question then arises, what are those means, and, I believe, in this matter that you must be the judge; but to be recognized as the

judge you must be able to convince your contemporaries by reasoning which appeals to them. Whence came Washington's power? I am clear that his power over his generation lay in the conviction of those whom he advised, that he was a shrewd and far-sighted man of affairs, who knew how to make a bargain, and disliked waste. If he spent money, he spent it where he expected a return. That return might be distant, but, as far as human foresight could go, men felt that Washington's judgment was sound. So it should be with you. If war be one phase of economic competition, then economic conditions become to you important as the basis of campaigns, and trade-routes are factors in strategy. Other things being equal, that force will prevail which is best equipped, and your equipment must depend upon the supplies granted you by a commercial community. You have a double reason, therefore, for addressing yourselves to these problems; the first is to obtain for yourselves the most accurate ideas of the probable character of the wars in which you may engage; the second is to demonstrate to the public their stake in the conflict.

Unless I am wholly in error, safety lies in being able to concentrate superior force at the point where rival trade-routes converge. Had the English comprehended this axiom they would not have suffered Braddock's defeat, not lost the thirteen colonies.

Common sense indicates that if you convince the public that you understand their economic interests, and that you only ask to insure their lives and their property, you will be granted what appropriations you may need.

What I deprecate is a dangerous jealousy of the soldier which is an ancient inheritance partly bred from the fact that military men use a language apart from the language of commerce. From generation to generation the tradition has been transmitted that certain wicked and cruel monsters have enslaved their kind from ambition or ostentation. I doubt if such men have ever lived, for great events turn not on such trivial causes. If a conqueror exists he exists because the conditions of his time demand that he should be evolved, and previously those same conditions must have evolved an army. Armies are created by necessity, not by caprice; and Augustus did not rule Rome by his own volition, but because order and property could by no other means be defended so cheaply and so well.

Take the case of Napoleon. Napoleon was raised to the throne

by Frenchmen because they were fighting for their lives and fortunes against England. It was a question of national supremacy. That issue decided, Napoleon fell, war ceased, and France presently became a republic; but when she became a republic she definitely laid aside her old ambitions.

As between America and those whose interests clash with hers, one side must yield, and the only argument to which men have yet submitted when the great prizes of life were at stake, is the argument of force. He who is unarmed is the slave and the victim of the soldier; while he who is armed shares in the fruit of victory. Once admit these premises and the conclusions are irresistible. Safety lies in strength. When nations have thus learned to appreciate human limitations, the position of the military services is impregnable.

One word and I have done. If my forecast is at all correct administration is the paramount necessity of the future. To enable America to achieve her destiny she must create administrators stronger than any who have lived heretofore. I submit that all history proves that the greatest administrators have been soldiers, wherefore I infer that the military education stimulates the administrative faculty.

The civil education has paid little heed to such matters. If a civilian becomes an administrator he does so almost in spite of his instruction, and because the accident of after life has thrown him where he was incited to learn. He might begin in a railway manager's office, but if he rose, his rise would be due to his own talent and energy, and not to previously acquired aptitude.

We all know that from the day a boy enters Annapolis to the day when he retires from the service as an admiral, he is busied with administration in some of its varied forms; but I believe that much might still be done to elevate this department of instruction in the public esteem. In this respect civil institutions must long be pupils of the military, and the navy of the United States could do no greater public service than by establishing and giving prominence to a standard of administrative instruction which schools and colleges might eventually try to emulate.

Look where we will, the field which opens before the American navy is vast and demands alike the highest powers of the mind, and the intensest effort. I firmly believe no century has ever unfolded more superb possibilities than the twentieth cen-

tury will unfold to you; but, conversely, your responsibilities are at least commensurate with your opportunity. Your task is to carry your country through the dangers which will beset her as she climbs the path to economic supremacy; a path in which errors such as those committed by England in 1774 may be fatal.

As Washington said a century and a quarter ago: "It is to be regretted that Democratical States must always feel before they see," for "it is this which makes their government slow." In my judgment this failing constitutes our chief danger, for modern life is fast. Modern warfare requires not only a highly scientific body of trained men to act as officers, but modern fleets take many years to build. On the other hand, when the blow falls, it falls suddenly. In a few days a decisive battle may be fought, as the French found in the campaign of 1870. Safety therefore lies in patient preparation and in rapid action. Such being my opinion I cannot too strongly urge upon you, as one of your weightiest duties, your responsibility toward your country in this behalf. A portion of your task should be to foresee and explain the action of those competing currents of trade which, when brought into conflict, must, as a condition of survival, make it necessary to take and hold certain dominant positions. That means war unless one party is too strong to be attacked. To perform this function you must, in a degree, become popular teachers, for on you, more than on any other class of the community, devolves the task of eradicating prejudices, and of diffusing intelligent ideas on this great class of subjects with which you, of all men, are most competent to deal.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AUTOMOBILE TORPEDOES; THEIR USE AND PROBABLE EFFECTIVENESS.

Lecture delivered before the U. S. Naval War College, Newport, R. I.

By LIEUTENANT LLOYD H. CHANDLER, U. S. Navy.

(A) IN LARGE SHIPS. (B) IN TORPEDO VESSELS. (C) IN SUBMARINES.

It is proposed to treat this subject under the following subheads:

1. The torpedo itself as a mechanical device. What it can do if properly handled, and what it actually has done in the past, in war and in exercise. The various kinds we now have in service.

2. Method of mounting the firing apparatus on board the different classes of vessels.

3. Method of operating and probable results to be obtained from the use of the torpedo.

4. Argument for the retention of the submerged tube on board large ships.

5. Maneuvers that should be undertaken to determine in time of peace the probable effectiveness of the torpedo in time of war, both preliminary, for the establishment of the rules of the game, and in the game itself.

6. Devices and methods that would be used by an active flotilla operating against an enemy.

7. The use of the torpedo as a defense of a harbor not suitable for mining operations, and the special value of submarine boats for the same purpose.

8. The collapsible-exercise head for torpedoes, and what may be accomplished by its use.

I. The Torpedo Itself as a Mechanical Device.

1. Before proceeding to touch upon the actual efficiency of the torpedo as used from the three classes of vessels named in the title of this lecture, it will be well to first consider what forms of torpedoes are now issued to our service for use. Apart from the Iowa, which still carries Howell torpedoes, we have in our navy only the Whitehead, but of this we have five different varieties or "Marks," as they are called. They are all 18 inches in diameter, but there are two different lengths, 3.55 meters, and 5 meters. The different marks represent the progress that has been made in the improvement of the weapon since we first adopted it. The Mark I, 3.55 meter torpedo is the first that we took up, and while we still have several hundred of them on hand, they have been retired as far as possible from active service, and are held as a reserve. The Mark II, 3.55 meter was the second step, and while considerable better than the Mark I in mechanical details, is to be considered as in about the same category as the Mark I. Neither of these marks is fitted with the gyroscope for steering the torpedo in the horizontal plane, and therefore they must both be considered as out of date.

2. After them came, concurrently almost, the Mark III, 3.55 meter, and the Mark I, 5 meter. After these were designed and under construction, the Obry gear was developed, and, as an afterthought, it was installed in these two marks of torpedoes, more or less disturbing the weight-arrangement in both, but to a much greater degree in the shorter torpedo. In mechanical arrangement these two marks are the same, the only difference being that the larger one has greater speed and endurance, and is a more accurate and a better weapon. It is thought that no more of the 3.55 meter torpedoes will be built, as the 5 meter weapon is much more accurate and reliable. However, the Mark III, 3.55 meter, may still be considered a modern and accurate weapon.

3. The latest design of torpedo in service is the Mark II, 5 meter, and, while designed for use with the Elswick submerged tube, it may be used from any of the other launching apparatus

already in service. To show what may be expected from this last type of torpedo, the following quotation from the specifications under which they were constructed is given:

"Each torpedo, with the Obry steering gear removed and the dummy inserted in its place, is to be set for a range of 800 yards, and the depth, speed and deviation taken at that range. The limits of deviation at the 800 yard target shall not be more than 24 yards to the right or left of the center of the target. The limit from the set depth shall not exceed 15 inches.

"The above conditions must be obtained with each torpedo in three out of five successive runs. The speed of each torpedo, as determined by the means of these three runs, must be at least twenty-eight and one-half knots an hour for the range of 800 yards.

"Having successfully met the requirements of the two preceding paragraphs, each torpedo shall have the dummy removed and the Obry steering gear inserted and connected up, and will then be set for a range of 800 yards, and the depth, speed and deviation taken at that range. The limits of deviation at the 800 yard target shall not be more than 8 yards to the right or left of the center of the target. The limit from the set depth shall not exceed 15 inches.

"The above conditions must be obtained with each torpedo in three successive runs. The speed of each torpedo as determined by the mean of these three runs, must be at least twenty-eight and one-half knots an hour for the range of 800 yards.

"Before any torpedo is finally accepted, it shall be run over a range of fifteen hundred yards with the Obry steering gear in action, and shall show a speed and the ability to maintain a straight course equal to the best results obtained abroad in said particulars, for the same type of torpedo when run over a corresponding range."

4. The results actually obtained under the above specifications considerably exceeded the requirements, and were as follows:

Speed at 800 yards. The torpedoes built on these specifications averaged about 30 knots for the 800 yard run, instead of the 28½ required.

Accuracy at 800 yards. At this range the results were well within the limits laid down.

Speed at 1500 yards. Twenty-four knots was attained.

Accuracy at 1500 yards. The torpedoes had no difficulty in keeping within 15 inches of the set depth, or coming within 20 yards of the center of the target on either side.

5. The results given are those actually obtained on the proving ground, firing from a ship at anchor through a net, so that both the speed and the deflection are most carefully and accurately measured. As far as the mechanism of the torpedo is concerned,

there is no reason why these results should not be continually repeated on board ship, under experienced handling.

6. At this point I desire to speak in passing of one feature of the Obry gear, or gyroscope, as it is now technically known, which is, I think, not generally appreciated. It is not known to all that a properly adjusted gyroscope causes the torpedo to run in a straight line with accuracy after it gets in the water, but to my mind this is not its most valuable feature. Torpedoes have been made to run straight without it, with a very considerable degree of success, although never with the certainty that a properly handled gyroscope gives. In fact the torpedo builders were so certain of their results on the proving ground, from a stationary platform, that they did not want to adopt the Obry gear, saying that they considered that just as good results could be obtained without it as with it. What they never experienced was the difficulty in aiming due to the motion of the firing-platform, or to a rough sea. In firing, the point of the torpedo leaving the tube and the supporting guide stud being released while the tail was still supported in the tube, the nose dropped, and entered the water first. The result was that the momentum of the firing platform carried the tail of the torpedo in the direction of the motion as soon as the head had its forward momentum checked by entering the water. This caused an uncertain deflection which had to be allowed for in aiming, which was in turn largely complicated by the ascending motion added when there was a sea running, or when firing from the stern tube of a boat into her own following wave, for instance. With the gyroscope, however, the steering mechanism takes charge in the tube, the instant the torpedo starts to move, and no matter what deflection is encountered on entering the water, as soon as the torpedo starts to run it comes back to the original line in which the tube was pointed when the firing key was pressed. Thus we now only have to allow for the speed of the enemy; to fire at the point where he will be when the torpedo has finished its run. The immense simplification of aiming which has resulted from the adoption of this device must be apparent, and the gyroscope has made out of the torpedo a weapon, which, within its range, is far more accurate than the gun.

7. Two new devices have been adopted in our service, although

not in general use as yet, which have both added greatly to the efficiency of the torpedo as a weapon. Both of them are now present on board the Decatur, and both are giving eminent satisfaction. A third device is also under experiment, which, it is confidently expected, will also add much to the general usefulness of the arm. The devices are:

a. The Mark II gyroscope. This differs from the Mark I gyroscope, or Obry gear, in that it has its wheel spun by air impulse instead of by a spring, and is thus always ready for instant service without winding; that its parts are so arranged that it can be adjusted in the shop before being put aboard ship and then will remain in adjustment, being capable of disassembling for cleaning without disturbance of adjustment; and that the valve mechanism can be readily so set that the torpedo may be either run straight after firing or else turn through any desired angle to the right or left (up to 120 degrees) after striking the water, before taking up its straight run. This last power enables the commanding officer of a torpedo vessel to stand at the con, with tubes trained on either side, to point his ship at the spot he desires to hit, and then, by electric firing from the con, to discharge torpedoes from all tubes in the ship simultaneously, in such a way that they will run parallel to the course of the ship. With a three-tube boat like the Morris he could thus discharge three torpedoes running in a danger zone about 100 yards wide, one on each side of the zone, and the third down the middle of it. The possibilities of a hit under such circumstances are enormous. Many variations of this form of attack are possible, but lack of time forbids me to dwell upon them here.

b. The superheating device, whereby the air drawn out of the flask is heated by an alcohol flame before going to the engine. This device is entirely automatic, is comparatively simple, is absolutely safe, and increased the speed of the experimental torpedo in which it was tried from 30 to 35 knots, approximately, for the 800 yard run. Of course any such marked increase in speed increases the chances of a hit by reducing the time of flight. This device also increases the total distance that it would be possible to make a torpedo run.

c. The third device referred to, which is as yet only in an experimental stage, is the adoption of a turbine engine for the torpedo. The results obtained so far would indicate that the efficiency of such an engine would be about the same as that of the Brotherhood engine already in use, but where the utility of the device would come in, would be in the fact that with the turbine we can take advantage of a degree of superheating of the air which would quite ruin any reciprocating engine. I look to see, in the near future, a great simplification of the torpedo engine by the adoption of the turbine, with a jump in speed to at least 40 knots for the 800 yard run, and a corresponding increase of range at a slower speed to fully 2500 yards.

8. To substantiate my claims as to the accuracy that it is possible to obtain with the modern torpedo, I wish to give you a summary of the work actually done by the flotilla under my command in a drill before the Secretary of the Navy and others in the waters of Narragansett Bay on August 14, 1902. The flotilla then consisted of the Decatur, Bagley, Barney, Biddle, Shubrick, Stockton and Thornton. The first named is armed with two torpedo tubes, and fired two Mark I, 5 meter torpedoes, fitted with the Mark II gyroscope. Each of the other six boats carries three tubes, only two of which can be fired from the same broadside, and each boat fired two torpedoes, all of them 3.55 meter, Mark III, fitted with the Obry gear, except one from the Biddle, which was a 3.55 meter, Mark II, without the Obry. The target consisted of a platform about 75 feet long floating upon barrels. In prolongation of this, one on each side, were two yellow flags so spaced as to represent the turrets of a 500 foot battleship. Beyond these again were red flags to mark the ends of the ship. The attack was made in column, the Decatur leading. The Decatur's tubes were pointed, one on each beam, with the gyroscopes so set as to converge the torpedoes right ahead at a distance of 1000 yards. Steaming at about 20 knots, directly for the target, when at a distance of 1000 yards, both torpedoes were fired simultaneously from the bridge by electricity, and both went within the turret flags, one passing under the float. The rest of the boats passed up the bay, and then countermarched, and returned, passing under the bow of the Decatur, which had stopped. When right ahead of the Decatur, at about 800 yards from the target, steaming at from 20 to 23 knots, with the helm well over to swing clear of the beach, each boat fired two torpedoes from her port battery. Of the twelve torpedoes thus fired, one from the Stockton caught its tail in the tube and did not leave the ship. All of the other eleven hit between the turret flags of the target. Two of them actually hit the platform, it being necessary to cut one of these out of the barrels of the float. A number of them passed under the floating platform. The net results were that, out of the fourteen torpedoes fired, one failed to get clear of the ship, and out of the thirteen fired (with all of them in the water at the same time), every one of them struck between the turret flags of the target.

9. Bearing upon his same point, I would like to present the record of the torpedo in which the first experimental, Mark II, gyroscope was tried. In the summer of 1901 I took charge of these experiments and ran this torpedo nineteen times. At first we had some trouble due to lack of knowledge of the intimate details of the gear, but even then we secured eleven perfect runs to eight bad ones, and of the eleven good ones the last seven were consecutive. Having in the first twelve of these runs eliminated certain hitherto unsuspected causes of error, I turned the work over to Lieutenant G. W. Williams (being called away from the torpedo station myself), and he made thirty-six runs, of which thirty-three successive runs were perfect. This gives a total record of runs, including the experiments carried on to find out what faults there were in an entirely new device, of 55 runs, of which 44 were perfect. Of the runs made by Lieut. Williams, 20 consecutive runs were made without oiling or adjusting the gyroscope, and five consecutive runs were made without removing the gyroscope from the torpedo.

10. The general usefulness of the gyroscope may be seen from two instances, both of which form a part of my personal knowledge. The first was a test of the Obry gear that I made aboard the Mackenzie. A torpedo was fired from her stern tube, at about 17 knots, helm hard over, the tube trained broad on the quarter. The torpedo was thus discharged into a high following wave, and all the observers agreed that, on striking the water, the tail was thrown forward at least thirty degrees. Notwithstanding the fact that no allowance was made for this deflection in aiming, a perfect run was secured, the Obry gear promptly bringing back the torpedo to the line of fire of the tube at the moment of firing. The second case was aboard the New York. A torpedo was fired from her broadside tube, with so much strain that the torpedo struck the lever-arm holding the port open. The head was cut open and the torpedo thrown into the water in a very rough fashion, with much deflection. In spite of the deflection, and the jagged cut in the head, a perfect run was secured.

II. Method of Mounting the Firing Apparatus.

11. Passing from the torpedo itself to the means of firing it, we have several forms of tubes, each form fitted for firing from

different positions on board different types of ships. They may be briefly summarized as follows:

a. From heavy ships. We formerly used above-water tubes for large ships, but this method is dangerous, and has practically been abandoned, although the tubes have not yet been removed from all ships. It was replaced aboard the Maine, Missouri and Ohio, by the introduction of the Elswick submerged tube. One of these tubes was placed on each side, in a forward compartment, below the water line, with armored firing stations above water, one on each side. To my extreme regret, I have to record that after these three ships, the torpedo has been abandoned for large ships altogether by us, a thing that no other nation has thought it wise to do. Of this point I will speak again later.

b. For torpedo vessels. Tubes are mounted on deck, some boats carrying three tubes, and some only two. The two-tube boats (and our destroyers are of this type) have both tubes mounted on the fore and aft midships line, and can fire either tube on either side. Other boats have three tubes, one amidships, at the stern, capable of fire on either side, and the others, one on each side, in the waist, each one being capable of fire on its own side only. It may be said in general that the three-tube boats carry the smaller torpedo, while the two-tube boats carry the larger ones, and personally I had rather have two 5 meter torpedoes ready than three 3.55 meter ones. There are a few exceptions to this rule, notably that very remarkable boat for her size, the Morris, which carries three long torpedoes on a very small displacement. There are also some small boats which carry only two tubes for short torpedoes, both amidships, and capable of fire from both tubes on either side. Of these the best known are the Gwin, Talbot, Mackenzie and McKee.

c. Submarines. In this country the rule has so far been invariable with these craft, and they are all provided with one immovable bow-tube only. The mechanism of these tubes is extremely simple, and action is practically certain. Most of these boats carry three to five of the 3.55 meter torpedoes, but the latest one is fitted for 5 meter torpedoes, and I believe is to carry three of them.

III. Method of Operating.

12. Passing from the mechanical possibilities of the torpedo itself and the method of installing it aboard ship, to the method of making use of it after it has been placed in the hands of the people afloat, I can do no more than refer to a lecture on this subject that I delivered before this college in the summer of 1900. This lecture was entitled "Torpedo Operation in Naval Warfare," and to save repeating it here, I have here a sufficient number of copies to supply those who may desire to consider it in conjunction with this lecture. To repeat any part

of it here would so take up my time as to prevent me from now giving much information and data which I think has not heretofore been presented to the service at large, and I therefore ask you to indulgently consider the discussion of actual tactics from this printed pamphlet at your leisure, and thus allow me to pass on now to other points that have not yet been discussed. I will only state in regard to it, that subsequent experience has not led to any change on my part of the views that I held at the time of the first lecture, except in some minor details not worthy of mention.

IV. Argument for Retention of Submerged Tubes.

13. So far as I know, the only reasons advanced for the abandonment of the torpedo aboard heavy ships are as follows:

a. In above-water tubes its presence is too great a menace to the ship carrying it to justify its presence.

b. The submerged tube may possibly be deranged and not work when needed.

c. The torpedo is said to be inaccurate, and a discredited weapon generally.

d. The tubes take up room in the ship, and make construction more difficult.

14. I know of no other arguments against the torpedo aboard heavy ships than these, and it is my desire to touch upon these reasons in detail, as follows:

a. Danger from above-water tubes. I agree with this, and believe that this installation should be abolished.

b. Unreliability of the submerged tube. This is theoretical and against the experience of other nations. The Elswick tube, to which we bought the rights at great expense, is simple, the parts are heavy, and it is not easily liable to derangement. Results from it abroad have been excellent, and I stand personally ready to guarantee to make it work for us.

c. The torpedo is not inaccurate and unreliable, but, on the contrary, within its range, is far more accurate than the gun. Its range is less than the gun, but its effect is also infinitely greater. Facts are more convincing than theories, and I present for your consideration the records of firing set forth herein.

d. The submerged tubes do take up room in a ship, but aboard a large vessel there is plenty of room for them and everything else. Guns and turrets also take up room. The presence of tubes does complicate the constructor's work. So does the presence of guns and turrets. It is confessedly easier to build a merchant ship than a battleship, but, as that is no argument against the adoption of guns and turrets (it has

been used against turrets, however), on board warships, so also it should not be accepted as militating against the torpedo and the submerged tube, provided the weapon can make good for itself a claim for reliability and accuracy. I claim that it has done this when handled by those who know how to use it. The damning of the torpedo in the past has been largely because no pains have ever been taken to put it in the hands of people experienced in its use, and no piece of machinery, no matter how simple, will work under such conditions. A torpedo division, organized exactly like a gun division, is a necessity, can be easily arranged for, and will surely bring the desired results if composed of men who know their work.

15. Having covered all the points advanced against the torpedo that I have ever heard presented by its opponents, I now wish to present a brief statement of its usefulness. In a lecture before the War College last summer (1902) Lieut.-Comdr. A. P. Niblack pointed out that, with a fleet of nine battleships, in any formation, the area of maximum gunfire effect is within a thousand yards of the center of the formation, in general. In other words, a hostile fleet in column would strive to get you abeam of his center ship and something under 1000 yards away. Will he dare do this if he knows that you have torpedoes accurate to 1500 or 2000 yards, even if he have a much superior force? I believe not, and the presence of the modern torpedo with the inferior force may well save the day. The usefulness of the torpedo, if accurate, aboard a ship that is in a tight place is too evident to need repetition.

16. The matter then resolves itself into two questions, viz.:

a. Are the torpedoes and submerged tubes sufficiently accurate and reliable to justify their existence? To this I answer "Yes" most emphatically, and point to the records hereinbefore quoted for my proof. I also present in the following paragraph a brief statement of the results of automobile warfare up to the present date, and in so doing desire to call attention to the fact that these results were obtained with the older types, and in no case was a gyroscope used in any of these attacks.

b. Can the tubes be readily carried aboard ship? To this I also answer "Yes," for all ships above 8000 to 9000 tons displacement, provided the effort be made, and mere convenience of construction be not allowed to throw them out.

17. The record of past torpedo warfare is as follows:

a. May 29, 1877. The English Shah fired one Whitehead torpedo at the Peruvian Huascar, but it had not power enough to run the distance.

b. December 27, 1877. The Russian Tchesme fired a torpedo at the

Turkish Mahmoodoeh, and the weapon ran straight but exploded before reaching the target. The Russian Sinope fired another at the same time, but it failed to explode.

c. January 25, 1878. The Russian Tchesme and Sinope fired one Whitehead torpedo each at a Turkish guardship at the entrance to the harbor at Batoum, both of which exploded under and sank the Turkish vessel.

d. January 27, 1891. A torpedo launch from the Chilian Blanco, in revolt, fired a Whitehead at the Balmacedist armed steamer Imperial, but missed her.

e. April 23, 1891. The Chilian government vessels Lynch and Condell attacked the revolutionary fleet in Caldera Bay and fired five Whitehead torpedoes, one or more of which sank the Blanco Encalada.

f. May 14, 1891. The Condell and Lynch again attempted to surprise the revolutionary ships, but could not get near enough to fire.

g. April 4, 1894. The Brazilian government vessels Gustavo Sampaio, Alfonso Pedro, Pedro Ivo and Silvado attempted an attack on the revolutionary flagship Aquidaban, but were repulsed before they got within torpedo range. The next night they tried again, and, one of the four Whitehead torpedoes fired, sank their adversary.

h. July 25, 1895. The Japanese claim that in time of peace the Chinese Tsi Yuen treacherously fired a torpedo at the Naniwa Khan, but missed her. The Chinese deny, and probably truthfully, that this ever occurred.

i. September 17, 1894. At the battle of Yalu, the Chinese fired several torpedoes, but missed.

j. January 20, 1895. Sixteen Japanese torpedo boats attacked the Chinese fleet in Wei-hai-wei, but failed.

k. February 4, 1895. At the same place, the same attempt was repeated and failed.

l. February 5, 1895. At the same place, the same attempt was repeated and as a result the Ting Yuen, Wei Yuen, Lai Yuen were sunk at once, and the Ching Yuen was so disabled that she sank not long after.

m. It is here seen that, leaving out the doubtful case in which the Japanese claim a breach of peace by the Tai Yuen, and followed it up by a savage attack on her, out of eleven attacks, four succeeded, resulting in the destruction of seven vessels. With the improved weapons now in use it seems certain to me that at least equal and probably better results could be expected to-day, and this record appears to me sufficient to substantiate all that I have ever claimed for the torpedo; and that while it is not a weapon that is going to revolutionize warfare or lead to the abolition of other types of ships than its own peculiar carriers, at the same time it is an arm that is far too valuable to be abandoned, and one which will well repay the care and attention necessary for the maintenance of a properly organized torpedo service.

V. Maneuvers that should be Undertaken.

18. I have been personally present at, I think, all of the torpedo operations undertaken in maneuvers during the last five years, and I am confident that in no case have the conditions been in any degree approximate to those that would be found in actual warfare. To get any useful experience out of such maneuvers, it will be necessary to first carry out considerable preliminary work, and this I had hoped to secure during the last winter at Culebra. Unfortunately other work interfered, and but little was accomplished. The programme of this preliminary work that I submitted to the Commander-in-Chief is contained in the following official letter from me to that officer on the subject. I may say that this programme was generally approved by those in authority, but the work laid down for the heavy ships prevented its carrying out. No maneuvers between fleet and torpedo boats were carried out during the winter maneuvers. The proposition that I made is as follows:

U. S. S. Decatur,
Great Harbor, Culebra, December 4, 1902.

Sir:—"Having been unofficially informed that, in the near future, there is to be a blockade of this harbor, which the torpedo boat flotilla under my command is to try to break, I most respectfully submit the following suggestions, etc., as to the method of carrying out such a war-game which I believe will give the most valuable results:

"As I understand it, the proposition is that a foreign fleet of eight ships shall blockade Great Harbor, while the torpedo boats try to break up the blockade. While Great Harbor is to be the scene of operations, I assume that the object is to so operate as to find out exactly what the boats would be worth under such circumstances for the protection of one of our important home ports, and also to gain as much experience in this kind of work as possible for the greatest number of people. It is with a view to securing the adoption of a scheme which will best accomplish these objects that I submit these suggestions.

"The object of the blockaders is of course to maintain an efficient blockade, to prevent merchant ships from getting in and out of the harbor without material risk of capture, to maintain their stations on blockade uninterruptedly, and to protect themselves from and drive back or destroy the boats.

"The object of the inside force is to pass merchant vessels through without their being obliged to take more than reasonable risk, and to destroy or disable the blockading force.

"As there are many points and rules to be decided before the game can begin, I most respectfully urge that, immediately upon the termination of the search problem, there be selected a board of arbitrators, who

shall decide upon all rules and points that are necessary before the opening of the game, and who shall decide also, from the reports and decisions of the umpires, all questions coming up during the game. I most respectfully request that the commander of the outside force may select one of the arbitrators, and that I may select another, and that these two shall select a third. Should this recommendation be approved, I most respectfully request that Commander N. E. Mason may be designated as the arbitrator chosen by me.

"I most respectfully recommend that the commander of the blockading force be allowed to select one umpire for each of the ships under my command, and one for each of the ships designated as blockade runners, to be on board throughout the game. As the personnel of the blockading force must be on the alert all the time, whereas that of the boats know when an attack is to be made and can rest at other times, it seems advisable to have two umpires on board each of the blockading ships, to stand watch and watch, and I respectfully request that I may be allowed to select these.

"Great Harbor being supposedly a fortified port, I respectfully recommend that batteries be supposed to exist on Breeze Point, Soldiers Point, and the hill on the west side of the harbor and just north of the canal. No ships can lie nearer than three miles from these batteries at night or nearer than six miles in the daytime. These distances are the closest allowed under any of our orders off Havana, and if the ships went within them they were speedily driven out by gun fire from the forts at that place.

"The outside force shall consist of eight ships, and of such aids only as they could have brought across the ocean with them.

"The inside force shall consist of seven torpedo vessels, three tugs, and three vessels, of supposedly 20 foot draft, to act as merchant blockade runners, all to be controlled by the flotilla commander. I think that this supposed force of auxiliaries is no more than we would be able to pick up in almost any home port, and therefore reasonable under the circumstances.

"The game shall begin at noon, Monday, January 5, 1903, and shall continue six days and nights, until 8.00 A. M., Sunday, January 11, 1903, and shall be conducted under as nearly as possible war conditions.

"In order that the maximum amount of experience may be gained by the greatest number of people, it is suggested that both forces be rehabilitated every morning, each night's work to be considered separately, the grand result to be decided by the total of six nights' work.

"A series of questions as set forth below shall be decided by the arbitrators before the game begins.

"How many ships of the blockading force must be destroyed or put out of action in one night to break the blockade? It seems to me, that, with a total blockading force of eight, the putting of two of them out of action would break the blockade.

"What percentage of merchantmen must go in and out in safety to show that the blockade is ineffective? If I can get two merchantmen

through in safety in a night it seems to me that the blockade is not effective.

"What percentage of relief ships, if any, would an enemy have available to use on such a blockade? I do not believe that they would have more than two extra ships to devote to such a purpose. In this connection it is essential to proper playing of the game that none of the relief ships be allowed to come anywhere near Culebra when off duty, and that they have no communication at any time with ships that are or have been near the harbor. They must not be able to see or hear of the flotilla arrangements any more than they would in actual war.

"How far off can a battleship see a torpedo boat? I have to suggest the following series of experiments to determine this point. Put one arbitrator aboard a battleship and another aboard a boat, on a night of standard conditions. Then with the truck light of the ship displayed:—

a. I will run directly towards the ship with a boat, the ship not to have her search lights on, and when the arbitrator aboard the ship sees the boat and fires a star, I will stop the boat, and the arbitrator on board the boat can take the actual distance with the stadimeter.

b. Repeat this test with the searchlight. Let the ship turn on a searchlight and hold the beam steadily on a given bearing. I will take a boat out and run down the searchlight beam until discovered.

c. It has been stated to me that one searchlight beam cannot be used through another. For instance, in regard to the army and navy manœuvers of last summer, Major Wisser informs me that while he was at Fort Adams, the searchlight at Fort Wetherell was held steadily on Brenton's Reef Light Ship. Major Wisser stated that while this was done, the light from Fort Adams was totally unable to pick up anything outside of the beam from Fort Wetherell. If this be the case, a fort could throw a beam down to one side of a ship, the boats could run down with the beam between them and the ship until very near her, without her being able to see them, and could then dash through and fire, or might even get within torpedo range while remaining on the outside of the friendly beam. Trials of this point would be interesting. The answer to the leading question of this paragraph should be determined from the results of these experiments.

"Under the same answer to the above question, let us suppose that a lookout sings out 'Torpedo boat on port beam.'

"How soon can a gun-pointer see her, swing his gun to bear, pick her up over the sights (setting sights is necessary), and fire one aimed shot?

"What proportion of such shots will be hits? To find the answers to the last two questions, let a target be made representing the bow presentation of a torpedo boat; anchor it at some convenient spot, get a range for steering a course by it passing 800 yards from it; start a battleship down the range at full speed on some night of standard conditions; let her pick up the target and open fire on it as soon as she can; keep up the fire for a period determined by previous experiment as the length of time she would have from the moment of sighting a torpedo boat until

the boat got to torpedo range; and, after it is all over, count the hits in the target. This would give the percentage of hits, and also their location and size would show what proportion of them would have struck the vitals of the boat in such a way as to disable her. It will be seen that this is an easier form of practice than would maintain in a real attack, for the relative speeds of ship and target will be too slow, the gun pointers will know about where the target will appear and will have their guns trained approximately, and it is easier to shoot at a stationary target from a moving platform than the reverse. A certain percentage of hits made in this practice should therefore be counted out for these reasons.

"What proportion of hits obtained will stop a torpedo boat, bearing in mind that, with these boats with separate steam-plants, a single shot to stop a boat, must do one of the following things: (1) Disable both engines; (2) Disable all boilers.

"From the above, how many minutes will it take a battleship to stop one boat?

"From the above, how many boats, coming in from different directions simultaneously, can one battleship stop in the time allowed from the moment of sighting them until they are at torpedo range? Answers to these last three questions can be deduced from the last experiment suggested.

"What is effective torpedo range? I claim 800 yards for short torpedoes and 1000 yards for long ones, and will make good the claim by records and experimental firing.

"What proportion of torpedoes will hit? At the above ranges, I claim 75%, and will make good the claim by records and experimental firing.

"What proportion of torpedo hits will sink a ship, and what proportion will disable her from service? I claim that 75% of torpedoes that hit a ship will sink her, and that any explosion of a torpedo under a ship's bottom will put her out of service until she can be docked and repaired. I believe that history will bear out this claim.

"What has a blockading ship got to do to one of the merchantmen to constitute a capture? I believe it only fair that she should be compelled to keep her under her guns for fifteen minutes, and then actually send a boat aboard her.

"What speed can be allowed a blockade-runner. Take the Prairie as a fair sample of the kind of vessel that would be used. She used to hold 16 knots between New Orleans and New York, heavily laden, in almost all weathers. I therefore think that a spurt speed of 17 knots would be fair.

"Boats in attacking a ship should fire a star to represent a torpedo, and ships should open fire with a star or blank on seeing a boat, the decision to be made from the times of star firing, with the time allowance for the boat to run under fire before being put out of action.

"The programme set forth herein involves considerable work, both preliminary and during the game, but if the thing is worth doing at all it is worth doing well. This is the first time in our navy that the boats have been given a chance to do this, their legitimate work, under any-

thing like war conditions, and it seems to me very desirable that we should get at some facts in regard to this style of warfare, instead of basing our arguments as in the past on assumptions made by those prejudiced either in favor of or against the torpedo. I believe that by working on the lines suggested we may acquire some valuable knowledge. If the boats are more dangerous than is supposed by the greater part of the officers of our navy, as is believed to be the case by those who know them, it is certainly most necessary that we find it out for ourselves, rather than by having it forced upon us to our great cost by some foreign power with whom we may in future be embroiled, and for that reason I most respectfully urge that this opportunity be employed to the utmost, for a more favorable could hardly be offered."

Very respectfully,

L. H. CHANDLER,

Lieutenant, U. S. Navy, Flotilla Commander.

The Commander-in-Chief, North Atlantic Station (Through Second-in-Command).

19. The only work undertaken was a short series of experiments carried on between the flotilla and the Nashville, of which the following report from me to the Commander-in-Chief on the subject gives the results:

U. S. S. DECATUR,

SAN JUAN, P. R., January 6, 1903.

Sir:—"I have to make the following report of the visibility tests of torpedo boats conducted by the flotilla under my command in conjunction with the Nashville during the recent maneuvers.

"The object being to determine merely how far it is possible to see a torpedo boat under normal conditions, the Nashville anchored in a given position, exposed two red lights vertically over each other and 95 feet apart. The boats then came in towards her one at a time, on a known bearing, and when discovered a star was fired from the Nashville at each boat. As soon as her star was discovered, each boat observed the stadimeter distance from the Nashville. The weather on both the nights the work continued was normal, clear and pleasant, with no moon.

"On the first night the observers aboard the Nashville were not allowed to use binoculars, and the distances at which the different boats were discovered were as follows:—

Bagley.....208 yards.

Barney.....370 yards.

Biddle.....This boat was not discovered at all. The Nashville in this test discovered nine boats, although there were only seven there, and this led to a confusion on counting stars. The Biddle, as the sixth boat going in, turned on her lights when the Nashville fired her sixth star, at a distance of 2400 yards, thus giving herself away.

Stockton.....510 yards.
Thornton.....750 yards.
Wilkes.....1020 yards. Commander Niles of the Nashville informed me that this boat was not seen until some time after her star was fired, and that she was much inside this recorded distance when discovered.
Decatur.....660 yards.

"On the second night only four boats were present, owing to the fact that the Stockton, in going to sea for the test, ran down the Newark's steam launch, and the Thornton and Biddle stayed behind to help pick up the men. Not knowing of the accident, I proceeded with the work with the other four boats. The searchlights from the fleet, turned on on account of the above mentioned accident, seriously interfered with this test by lighting up the boats from one side, in the cases given below. In this test binoculars were used aboard the Nashville. The results of this night were:—

Bagley.....360 yards, and was seen only then because she was lighted up by searchlights of the fleet.
Barney.....2100 yards, but was brilliantly lighted up by searchlights of fleet.
Wilkes.....650 yards.
Decatur.....1370 yards.

"The net results of this work seem to me to indicate that without searchlights a ship cannot hope to keep off the boats, and cannot see them in most cases until they are within torpedo range (800 yards for the short torpedo and 1000 for the long). It must be remembered that in these tests but one boat came in at a time, she came in within a very few minutes of a known time, and on a known bearing, and all hands on board the Nashville were up and looking for them, all conditions very much against the boats. The results obtained under these conditions show very plainly what could be expected from a ship with a half dozen boats after her simultaneously, at an unknown time, from an unknown direction, at a time when the personnel of the ship was worn by constant watching. Like every experiment of the kind that I have ever witnessed, these results go to show the absolute impossibility of a ship's successfully resisting such an attack as the flotilla under my command could and would deliver.

"I regret that time would not allow us to continue the experiments with the Nashville as we had hoped, for it was proposed to find out definitely how far a ship could see a torpedo boat when in her searchlight rays.

"It may be urged that searchlights will greatly help the ships of a blockading force to keep off the boats, but either the lights must be kept turned off until the boats are sighted, and then turned on (which is the usual custom), when the conditions are similar to those reported in the above tests, or else the lights must be turned on all the time, under which conditions we must either

a. Have enough blockaders to put them so close together that there can be no unilluminated zones between the ships, which means that they cannot be more than 3000 yards apart, a thing which would hardly ever be possible under ordinary conditions, or else

b. Have a series of finely illuminated lighthouses marking the intervening paths of safety for anyone who might choose to use them, and showing the boats exactly where their adversaries are and from what quarter it is best to attack them.

"Believing, as I most emphatically do, that a battleship once found by a group of boats is absolutely at their mercy, it is with the utmost regret that I start for home with the flotilla without making some service test of the boats against the battleships. Such a test, to be of value, must be so arranged as to introduce the two features which make in favor of the boats in war, surprise and fatigue on the part of the attacked, and therefore a single night's operations are of little value for this purpose. I most earnestly recommend that at the first possible opportunity a week be devoted to this work on the lines which I have heretofore suggested, in order that we may find out for ourselves what there really is in this style of warfare, rather than learn it in future from some foe."

Very respectfully,
L. H. CHANDLER,
Lieutenant, U. S. Navy, Flotilla Commander.

Admiral George Dewey, U. S. N., Commander-in-Chief, Combined Naval Force.

VI. METHODS OF OPERATING AGAINST AN ENEMY.

20. Had the maneuvers that I have always longed to see been permitted on this occasion, I had in mind a series of attacks that I think would not have failed to effect satisfactory results from the point of view of the defenders of the harbor. All that I wished to control was such a force as would ordinarily be found in any of our harbors, the torpedo boat flotilla then under my command, a few tugs such as can be found in every one of our harbors that would be worthy of blockade, and a few vessels to act as blockade runners. I stood ready to take any of these vessels, up to and including 20 feet draft, in or out of Great Harbor at any time of night, to the satisfaction of the enemy's umpires, by any of the channels around Culebra Island. My programme for five nights would have been on the following lines, and I believe that none of the extemporized methods adopted are other than those that a lively, experienced and well-organized defense would use in actual service. I stood ready to fire torpedoes accurately by any and all of the methods that I proposed

to employ. The nightly proceedings would have been, for my part, about as follows:

a. First night. Tugs to run out at eleven and stir up pickets. Torpedo boats to leave as soon as the picket line is shown up, avoiding discovery, and run well to the eastward, remaining at sea all day. Tugs to stir up blockaders again at three. The tugs would run out and cause the pickets to sound the alarm, and then retreat. Also by making an appearance of torching funnels, while at a considerable distance from the blockaders, they can cause an appearance of torpedo boats close at hand, and lead to much disturbance and loss of rest and ammunition with comparatively little risk to themselves. They would be painted torpedo boat color. At some time during the night one or more merchant ships to run the blockade.

b. Second night. Tugs to stir up the blockaders at eleven. Tugs to stir up the enemy again at two-thirty, at which time the torpedo boats attack from the seaward as soon as the tugs compel the enemy to develop his position. Merchant ships run blockade at eight. Tugs and people in harbor to keep up smoke, and other appearances of the presence of the torpedo boats during the daytime at all times.

c. Third night. Torpedo boats will attack from the inside at one hour after dark. At midnight a tug will tow out small boats, each with a torpedo secured alongside ready for firing. These boats will be towed up to windward, and after a proper time the tugs will stir up the enemy to leeward. While the excitement is going on, the small boats under sail will run down (sails painted green) into the blockading fleet and use their torpedoes. Merchant ships run blockade just before daylight.

d. Fourth night. If by this time the blockaders have become wary of the tugs, and refuse to waste ammunition on them, hoist one torpedo tube aboard each (can be done in a half hour) and make ready for a real attack by them. Use the torpedo boats for feinting on this night. Merchant ships run blockade.

e. Fifth night. Torpedo boats leave soon after dark and hunt the resting place of the reserve ships of the blockading force, which will probably be somewhere within fifty miles, the ships resting, and not looking out for attack. Tugs stir up blockading fleet several times during the night, to keep things lively, and to make the reserve ships think that attacks are actually going on. Merchant ships run the blockade.

21. Such a system of attacks as laid down above gives the personnel of the defending force plenty of time for sleep, and must wear out and dishearten the blockaders in a very short time. There is no question in my mind that such attacks are certain to be frequently successful, and I do not believe it possible for a blockading fleet to stand in the face of them.

VII. The Torpedo as a Defense of Harbors.

22. A useful field for the employment of the torpedo, which I have not as yet touched upon, is for the defense of harbors not suitable for mining, both from regular or improvised torpedo batteries on shore, or from submarine boats. It is well known that there are many harbors in which, owing to a great depth of water, rapid current, or other causes of a like nature, it is almost impossible to establish a thoroughly reliable system of mines. Here we have a field in which the automobile torpedo is without a rival. In the first place the ease with which it may be fired is not thoroughly appreciated by most people. The regular firing tube may be set up almost anywhere in a very short space of time, for the recoil of firing is not great. It is also a fact that absolutely no launching apparatus is necessary. Two men may stand in the water and point the torpedo while another pulls the starting lever, and good shooting is easily possible by this method. An old barrel with the heads out forms an easily operated means of pointing in this manner.

23. A method of submerged firing from a stationary battery on shore may be also easily knocked together. If an ordinary above-water tube is available, all that is needed is a coffer-dam to hold it, of such a character as may be easily extemporized from readily available material, by a carpenter's gang of ordinary intelligence. The only change that would have to be made in the tube itself would be to take off the spoon and secure the tube-mouth to a hole in the coffer-dam by some form of sluice valve, and I feel sure that a wooden hull connection and valve of this sort could be readily made that would answer all purposes. Such coffer-dams should be constructed and temporarily moored as desired, and an enemy would have very little chance of knocking one of them to pieces.

24. The advantages offered by this style of harbor defense in places where mines are not available, or even as an adjunct to mines, are so great that I am at a loss to understand why it has not yet been taken up. A more powerful torpedo could be used from permanent shore batteries than it is possible to carry aboard ship, where the confined space available for handling marks the present five-meter torpedo as about the limit in length. By increasing the dimensions of the torpedo to about double those of

that now in use aboard ship, I see no reason why a range of 5000 yards with a speed for that distance of 30 knots should not be attained, by a torpedo carrying 200 pounds of explosive, and such a weapon should give a speed of over 40 knots for 1000 yards. From a shore battery, where range and position of the enemy can be readily determined, such a weapon should be absolutely accurate and reliable.

25. A great difficulty that presents itself in the defense of all harbors is the question of fog. A place like the Race, for instance, where mines are not reliable, furnishes a splendid field for use of the torpedo. I think it will be admitted that an enemy who had a sufficient knowledge of our coast to enable him to dare the risks of ordinary navigation, would stand a very fair chance of success in an effort to take his fleet through the Race in thick weather, as far as the stationary mines and shore defenses are concerned, and when the immense advantages to be gained by such procedure are considered, I have no doubt that any wide-awake enemy would do just that thing. But would he dare to try if he knew that there were a half-dozen submarines, armed with modern torpedoes, cruising to and fro across the passage? And if he did try it under those conditions would he not be more than likely to pay an enormously high price for this effort?

26. Therefore, I believe that, in all harbor defense work, but especially in those special harbors where the use of stationary mines is beset with unusual difficulties, the use of the automobile torpedo is an absolute necessity, and one that is very unwise to neglect in the way in which we are now doing. Regular shore submerged batteries, with powerful torpedoes; extemporized shore batteries, submerged or otherwise, with our service weapon; and the mobile torpedo batteries furnished by the submarine boats; taken in conjunction with such stationary mines as can be used, and an outer and constantly shifting line of regular torpedo boats will beyond question form a defensive barrier that it would be madness for a hostile fleet to attempt, and the two mobile features of such a defense would also go far to keep such a fleet at a respectful distance from the harbor mouth. In a word, such a force, I believe, would render any such thing as forcing a harbor or maintaining a successful blockade impossible, except at such a cost that no nation would be able to stand it.

VIII. The Collapsible Exercise Head.

27. In order to secure proper practice in the use of the torpedo under war conditions, we should experiment with a device now much in use in foreign services which enables a torpedo to be actually fired against a ship in maneuvers. The regular exercise head of a torpedo is a steel shell filled with water, and the incompressible nature of its contents makes the torpedo a dangerous thing even for exercise, if directed against a ship, for with that practically solid head, I think that such a pointed mass of half a ton moving at a speed of thirty knots would probably penetrate the hull-plating of almost any ship. So abroad they have gotten up a collapsible head, which crushes and stops the torpedo without damage to the ship. I do not know just what it does in the way of injury to the torpedo, but the report is that it does none. I should think, however, such repeated shocks to the torpedo must injure its mechanism if used many times. However, the use of such a device (together with a calcium phosphide torch in the torpedo) is the only way that I know of determining just what torpedo vessels, etc., can do against ships, and I am greatly desirous of seeing the device taken up and experiments made with it in this country.

28. Another experiment that has been hanging in the air with us for some time is the attack of an armor-plate by one of the latest marks of torpedoes. I think this experiment would be a very useful one, and hope to see it carried out before so very long.

29. In closing, I wish to say that my hope throughout my work with the torpedo and its carrier, which has continued now nearly five years, has been merely to secure for this weapon the place in our navy to which I am sure it is entitled. The battleship is beyond doubt the backbone of a navy; with it, and with it mainly, wars will be fought and won, and I have no desire to advance any arguments which will in any way work to the disparagement of such vessels. I am sure, however, that in the torpedo we have a most important adjunct to the fleet, and it is to the removal of our wholesale service prejudice against it that I have given every effort. The knowledge gained of the torpedo by watching the older types used from big ships, where it is in charge of officers and men who in too many cases have had no experience in its use,

has ordinarly been the major part of the knowledge on the subject possessed by the service at large, and under those conditions, it is not surprising that the weapon has been generally condemned. I have watched the conversion of many doubters and enemies, and I have yet to meet the man who, after gaining an intimate knowledge of the arm in its modern form, has not become an ardent believer in the torpedo within its proper field. Both torpedoes and torpedo vessels require careful and experienced handling, and will not function properly in the hands of green personnel, but with a properly organized service they will repay the time and money spent on them. Both torpedoes and vessels will stand much hard service and many hard knocks, and come out successfully, but they will not for one instant stand what has been too often their lot, neglect and unskillful handling.

Since writing the above lecture, I have recently learned that the Bureau of Ordnance has contracted for new torpedoes, as follows:

1. Fifty 5-meter 45-centimeter torpedoes, with a guaranteed speed of 35 knots for 1200 yards, with a flask pressure of 2250 pounds per square inch. These are of the same size as the present service torpedo.

2. Two experimental 5-meter torpedoes, 21 inches in diameter, which are to run 4000 yards at a speed of 26 knots, and 3000 yards at a speed of 29 knots, on a flask pressure of 2250 pounds. These are therefore the same length as the service torpedo of to-day, and about three inches greater in diameter.

3. All of the above torpedoes are to be fitted with the modified gyroscope, allowing the curved run.

DISCUSSION.

CAPTAIN F. J. DRAKE, U. S. Navy.—Lieutenant-Commander Chandler's paper on "Automobile Torpedoes; their Use and Probable Effectiveness," presents a strong argument for the installation of the latest type of Whitehead torpedo in our battleships and cruisers.

There is no doubt that the moral effect of torpedoes carried by battleships and cruisers is very great, when it is considered that 75 per cent of firings on the proving ground, at a fixed target, under the most favorable conditions, are actual hits, as stated by the author. It must, however, be considered that the efficiency guaranteed, and which he has obtained, is undoubtedly the same that has been recorded by the English, French and Germans, in their exhaustive experiments under similar conditions.

It must also be considered that these are proving-ground results, with all preliminaries forestalled which are naturally essential features in determining the maximum errors in speed and deflection.

In order to give the greatest possible weight to the author's practical results in hits, let us accept only the highest efficiency in the torpedo, as a mechanical device; this considers the Mark I, 5-meter, and Mark III, 3.55-meter, in which the Obry gear has been installed and fired from torpedo boats essentially adapted and constructed for carrying torpedoes. In other words, rapidly moving platforms of highest tactical efficiency, far exceeding any which could be expected in battleships or cruisers.

It must also be considered that the target is fixed, that distances and courses are absolute quantities—conditions which will never exist in battle.

Under these circumstances, the author claims, on experimental trials with the Obry gear, 80 per cent perfect runs, with a maximum air pressure, which should have given about 1 minute, 25 seconds, for 1000 yards.

I find from personal experience in adjusting and firing with the Obry gear, that in the majority of cases the runs are successful, in so far as this device controls the torpedo on the course for which the gyroscope is set.

SUMMARY OF DETERMINED AND UNDETERMINED FACTORS OF TORPEDO EFFICIENCY.

Determined Factors of Efficiency.

(a) Moving platform 20 knots per hour.
(b) Eight per cent of directive force hits.
(c) Target stationary at 1000 yards.
(d) Time of flight average 1¼ minutes.
(e) Ranges carefully marked.
(f) Revolving tubes.
(g) Torpedo boats with highest tactical efficiency.

Undetermined Factors of Efficiency.

(a) Submerged tubes, fixed.
(b) Range, effective, 3000 yards.

(e) Average speed of torpedo, 20 knots.
(d) Course and distance of the enemy.
(f) Speed variable, depending on line of attack.
(g) Efficiency of torpedo at 3000 yards as compared with the gun.

We have 80 per cent of hits at 1000 yards, with revolving tubes, adjustable gyroscopes, known distances and stationary targets.

Considering the undetermined factors, what degree of efficiency can be obtained, from a conservative estimate, for submerged tubes.

Accepting the zone of torpedo range to be the extreme limit of 3000 yards, it becomes necessary for submerged tubes to be loaded, sluice valves open and gyroscope set previous to going into action; otherwise torpedoes may not be ready for launching at the most opportune moment when the enemy is estimated to be within the torpedo zone.

As torpedo tubes in battleships and armored cruisers are fixed tubes, it becomes necessary to bring the enemy upon the line of bearing previously determined upon, even with the adjustable gyroscope, allowing that the torpedo turns through a predetermined angle before taking up a straight course.

To settle upon a previously determined line and set the gyroscope for that angle, requires that the enemy must hold his course and speed within the torpedo zone, in order that the vessel having submerged tubes shall be able to discharge his torpedo when the former reaches that position which brings him on the latter's predetermined line of bearing, conditions which would probably never exist, even should the lines of attack force the enemy and the attacking fleet to hold predetermined lines of battle formation.

It certainly becomes a question involving the probability of chances; hence, starting with 80 per cent of hits at 1000 yards, let us see what percentage of handicap evidently exists for submerged tubes. This is the only line of analysis which can reasonably be accepted, and is entitled to equal weight with the author's guarantees in favor of retaining submerged tubes.

Therefore 80 per cent of hits at 1000 yards is equivalent to 24 per cent of hits at 3000 yards, with the target stationary. With both columns moving in apparently opposite directions at approximate speeds of 21 knots, the probable chances of hits would be reduced to 20 per cent, providing that it had been possible to so maneuver as to bring opposing vessels on a predetermined line of bearing, which are conditions of opportunity.

In the heat of battle where the firing has commenced at 5000 yards, which distance must sooner or later become the practice range, by virtue of the increased fighting efficiency which is being developed in the modern battleship, no commander can determine on what line of bearing he will discharge his torpedoes within their effective zone. Any calculation on this score is purely within the probability of chances, as the angular velocity at 3000 yards will approximate 41 feet per second, an interval of time and space in which it would be impossible for any torpedo expert to determine or decide upon any line of bearing for discharge, other than right abeam; the latter being less complicated, with the least handicap to the

speed of the torpedo. Hence, I see no use for the adjustable gyroscope in submerged tubes.

Besides, when maneuvering in battle formation under battle conditions, the courses are liable to changes at any moment, and under no circumstances are absolute. Therefore, the chances for a commander to lay his vessel for the purpose of discharging a torpedo in line of battle are not to be considered. If acting singly or in open order with one other vessel in the same line, any change of course for discharging a torpedo may not only throw out the line and produce confusion, but diminish his effective fire and expose his vessel to the more destructive fire of the enemy.

When these conditions are carefully considered in connection with the time interval of flight of a projectile compared with that of a torpedo for 3000 yards, and the additional handicap placed upon the torpedo by battle formation, while gun efficiency is being increased over 100 per cent, the percentage of hits becomes still further reduced below the calculated standard claimed in the discussion of war games, i. e., 20 per cent.

The record of past torpedo warfare quoted, as an argument for retaining the torpedo in battleships and cruisers, sums up 12 per cent of hits, all of which were made by torpedo boats attacking under the cover of night, the vessels attacked being at anchor, and without defensive precautions, which were taken only in one instance, as far as official records show, and that was at Wei-hai-wei, by a cordon of booms.

When the time of flight is considered at 3000 yards, the relation of torpedo to gun is about 1½ per cent in favor of the torpedo and 98½ per cent in favor of the gun.

A careful analysis of torpedo efficiency, as obtained in torpedo boats, is not, in my opinion, sufficient proof to warrant the installation of submerged tubes in battleships and cruisers.

They are admirably adapted to torpedo boats, by virtue of the latter's high tactical efficiency.

Twin-screw, seagoing torpedo boats of 2000 tons displacement, with protective deck and two submerged tubes, one on each side, having superstructure works for living quarters, with a light battery of 3-inch 50-caliber guns mounted on circular trunks built up from the protective deck, would be practical seagoing torpedo boats, capable of taking care of themselves under all circumstances.

If submerged tubes are questions of such vital importance in our battleships and cruisers, I can see only one way by which we can determine sufficient practical data relative to their efficiency, under battle conditions, to warrant their installation for all time; namely:

(1) To build eight experimental torpedo boats, each carrying two submerged torpedo tubes, one on each side.

(2) To be twin-screw boats, capable of making 16 knots speed, which will probably exceed the highest speed at which any future battle between armored vessels will ever be fought.

(3) To be protected in their vital parts, so as to resist penetration to torpedoes having collapsible practice heads.

(4) Then to have a tactical board assemble these boats in some suitable

bay having sufficient space for maneuvering two divisions of four boats each (A and B divisions respectively), one against the other, in such battle formations as may be established by the board. These boats being provided with powerful pumps for freeing unprotected compartments from water, will then be able to furnish the necessary practical data under all evolutions up to 15 knots speed, in the various attacks under battle conditions.

These maneuvers will determine the practical efficiency of submerged tubes in every phase of torpedo warfare, as well as furnish a school for torpedo games which cannot be excelled.

The valuable results obtained in such a torpedo war game will more than pay the cost of the construction of these boats, also future expense which will result from the installation of submerged tubes in our vessels to-day, without knowing one factor of their actual efficiency in future wars.

COMMANDER MURDOCK, U. S. Navy.—Any contribution by Lieutenant Chandler on practical torpedo work is always acceptable. It is strange that, in the prolonged discussion that has attended our naval reconstruction, there has been so little rational talk on the subject of torpedoes, that the service and the country at large are far from understanding the true position of the automobile torpedo in naval warfare.

Our present fleet of torpedo boats and destroyers is largely the result of the absurd panic over the Spanish destroyers raised in the newspapers in 1898. The fertile imaginations of a few correspondents magnified them into terrible instruments of destruction, and the population of our seaports quaked in their shoes from the fact that three of the enemy's destroyers were known to be in the North Atlantic. Congress, therefore, voted sixteen destroyers for our own navy and no others have been ordered since.

What we need is a sane and careful study of the whole question of automobile torpedoes. Naval opinion is crystallizing, but we are not surely removed from either of the two extreme opinions: one holding that the torpedo is too complicated and unreliable a weapon to warrant development; the other considering it as the most terrible instrument of destruction placed in our hands.

There is no doubt in the minds of officers, that a torpedo exploded alongside or under a vessel will cripple, if it does not destroy her. Argument, must, therefore, focus on the single question of, can a torpedo be made to hit, or, in one word, on its reliability. Nothing in the world can determine this but actual trial, and it is noticeable that all officers who have had extended torpedo-boat service agree with Lieutenant Chandler that the torpedo ranks with the gun in reliability. One expert puts it that the torpedo excels the gun in accuracy, from the fact that its errors are all in training—the serious question of elevation being eliminated.

It has sometimes seemed as though we feared that we might be convinced of the necessity for the automobile torpedo if we gave it a fair trial, and in that event would have to face the difficult problems attendant on its installation and the drilling of the personnel in its use. Any profes-

sional advance can be acquired only by meeting and overcoming difficulties—not by evading them. The country pays for the very best in its navy, and in time of war will make no allowance for neglect in perfecting the full offensive strength of our ships. We must study our problems in peace, with a view to war only, or run the risk of a fearful awakening.

Fortunately there is every indication of a marked change in the service opinion of automobile torpedoes, or, perhaps more properly, the true service opinion is beginning to assert itself, and torpedo warfare bids fair to hereafter receive the attention its importance demands. Lieutenant Chandler's efficient work in command of the first torpedo flotilla has gone far toward bringing this about.

COMMANDER E. B. BARRY, U. S. Navy.—Lieutenant Chandler has given us a most instructive and timely lecture. Apart from his enthusiasm on the subject he is an authority and tempers his enthusiasm with conservatism and expert knowledge so that what he says can be accepted as of the very latest. His descriptions and tabulations of torpedo runs and tests will be a surprise to many not in the confidence of the "inner circles."

I am pleased to note under II Lieut. Chandler's "extreme regret" that underwater torpedo tubes have been installed in only three battleships. I think the majority of officers share with him in this "extreme regret." His argument for the retention (in our service, it would be almost appropriate to use the word "installation") of submerged tubes seems to be unanswerable and I hope will go to swell the chorus calling for the submerged tube.

Concerning the "maneuvers to be undertaken" the points bearing upon blockade, breaking blockade, escape of merchantmen, etc., do not concern us, but the determination of effective operations, open to torpedo boats, visibility, chances of their destruction, etc., are highly interesting and of vast importance. The experiments are not conclusive, solely for the reason that time enough was not, or could not be devoted to the thorough thrashing out of these important points. However, the matter is now in such shape that, thanks to the energy and attention of Lieut. Chandler to the problems set him, he has paved the way to a solution as near war conditions as can be reached.

If all his contentions are sustained there can be no effective blockade of any port that can be defended by torpedo boats.

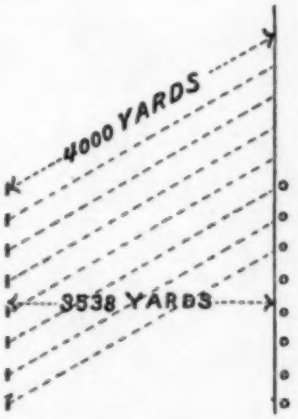
Commenting on "methods of operating against an enemy," I very much doubt if tugs can be employed against modern ships anywhere to "stir up the enemy." I think they all would be destroyed the first time they tried the stirring up game in real war. Far from the blockades becoming wary of the tugs, I think there is no way a tug can be disguised into a torpedo boat that cannot be penetrated very easily and quickly, so that the tugs would have to flee for life.

I concur fully in Lieut. Chandler's remarks on the proper care and handling of torpedoes. It seems superfluous to refer to the specialist in anything now, yet the question and its answer continually are cropping up. His closing sentence contains much food for thought that applies,

not only to torpedoes, but to any other special sub-division of our rising navy. "Both torpedoes and vessels will stand much hard service and many hard knocks and come out successfully, but they will not for one instant stand what has been too often their lot, neglect and unskillful handling."

COMMANDER BRADLEY A. FISKE, U. S. Navy.—Lieutenant Chandler's paper is, in my opinion, wholly admirable. I beg to state, however, that it seems to me that the torpedo is to become even more important in ships than in torpedo boats.

What will happen is that a United States fleet will some day find itself "lined up" against an enemy fleet. Each fleet will be the embodiment of every resource of its country, and of every effort of drill preparation;



and, since it will be essential that at no time shall a smaller force be caught by a larger one, each fleet will be the utmost possible concentration of all the ships of its country. Therefore, the result of the battle will determine the result of the war—absolutely.

Now, let us suppose the most probable case, that in which the two fleets are drawn up in opposing columns, steaming ahead as fast as they can; for simplicity's sake let us take 8 battleships in each and leave out of consideration for a while the armored cruiser squardons ahead, and the smaller ships, because they would probably engage with each other, and not form part of the real battle; not, at least while heavy gun-fire was going on.

To make a concrete case, let us suppose that the left fleet is in the diagram fitted with torpedoes like those just contracted for, that are to go 4000 yards at 26 knots; and let us also suppose that each fleet is going 12 knots. It may be objected that the torpedoes spoken of do not exist; of course, this is true, but they will exist, and this discussion pertains to the future, not to the present. It may also be objected that 12 knots is too low a speed; perhaps this is true; but the writer craves permission to let this stand as a fair compromise between what is often claimed as a fleet speed, and what is actually held as a fleet speed—*in formation*.

If now each ship of the left fleet discharges a torpedo 29° forward of the beam, the torpedoes will cover a space on the beam of the fleet extending out 3538 yards, within which the other fleet cannot come, without the certainty of encountering eight torpedoes, each one of which has one chance in three of hitting. It must be borne in mind that the torpedo's vertical error is inconsiderable at any range, and is independent of it; also that the vertical error of the torpedo, unlike that of the gun, is not increased by the rolling of the ship.

So, it is plain that a fleet that has torpedoes, submerged, of course, can establish around itself a zone, depending in size on the running distance of the torpedoes, inside of which an enemy's fleet *in formation* cannot come without meeting a danger so enormous, as to constitute a prohibition, even if the torpedo's lateral error should be very great, much greater than it really is.

Now, the running distance of a torpedo is capable of great increase beyond 4000 yards; *it is a mere matter of size and strength of flask.* It may also be very greatly increased by running at a speed less than 26 knots.

This being the case, may not the battle which we shall fight be fought at such great range, that gun-fire will be very ineffective? If so, may not the ammunition of one or both fleets be exhausted before anything decisive has been accomplished? If so, may not the greater part of the battle be fought with the torpedoes? If so, since both fleets will then be constrained to fight in dispersed order, and at long range, so that misses will be frequent, and since neither fleet can carry an infinite number of torpedoes, may not the victory, and the victorious result of the war, rest with the fleet that has the best, *and the most,* torpedoes?

This subject is getting complicated, and is suggesting all sorts of questions. For instance, will the armored cruisers and the smaller vessels join in the torpedo battle, after the battleships have used up their gun ammunition? As powerful torpedoes can be fired from a cruiser, as from a battleship.

LIEUT.-COMMANDER W. IRVING CHAMBERS, U. S. Navy.—The author deserves all the support and encouragement it is possible to give him in his efforts to set the torpedo question in its true light before the navy.

In regard to curved fire, I fancy he does not rest his advocacy entirely upon the method he outlines for using it from torpedo-boats alone. There are officers who would wish to have one torpedo arranged to fire ahead in line with the keel and another ready to train and fire straight, but the device is so simple that I doubt if any officer would care to be deprived of the means for using straight or curved fire at discretion.

I mention this matter more particularly to emphasize the advantages of curved fire from battleships, in which the tubes are fixed and submerged. The submerged tube can be readily arranged for setting the steering valve from outside the tube almost instantaneously.

As for collapsible heads, our exercise heads are practically collapsible, but they would be more collapsible if made of thin copper. They could

be further improved in this direction by being provided with exercise noses so arranged as to compress air and give a cushioning effect.

LIEUTENANT-COMMANDER ROY C. SMITH, U. S. Navy.—The service owes a debt to Lieutenant Chandler for his persistent advocacy of torpedoes, in and out of season. As he says, all the officers who have ever worked with them have faith in them, but none as far as I know has accomplished as much as he. The torpedo has reached a point to-day far in advance of the position it occupied only a few years ago, and at no time has any foreign power ever considered limiting the scope of its employment. In England, some years since, as a result of the use of torpedo-boats in the maneuvers, there was a considerable school that opposed them altogether. The advocates of the torpedo-boat found that it was the conditions of the maneuvers that imposed artificial restraints of time and state of the light that would not have obtained in war. None of the discussions determined the English admiralty to curtail the use of the torpedo.

The English do in a way take a different view from some other nations, the French, for instance. They have a powerful fleet of heavy ships. Their ships can take care of the enemy's ships. But the torpedo boat is largely a weapon of defense. A nation weaker in ships, or with an extended coast line, would resort to torpedo-boats. A nation with a restricted coast line and strong in ships would build destroyers to oppose to the enemy's torpedo-boats. This, then, is the English policy.

Its application to us is that though we do not intend to abate our efforts to upbuild the heavy line, still the very extent and conformation of our coast make the conditions ideal for the successful employment of torpedo-boats. The enemy cannot bring many small boats as far as our coast, but he will bring, naturally, destroyers. Here is the chance for our small boats to operate from shore bases against his heavy ships, and we need destroyers to take care of the enemy's destroyers and leave a clear field to the boats.

Destroyers are also the logical defense of the cruising fleet. Some years since it was the custom for ships to carry defense nets, a custom now practically obsolete. Then, it was supposed that the search-light would prove a sufficient protection. Lieutenant Chandler, in speaking of the Nashville experiments, where search-lights were not used, says: "The net results of this work seem to me to indicate that without search-lights a ship cannot hope to keep off the boats." This perhaps does not mean to imply that with the lights she might have done much better, but such at least is a very prevalent view in the service. I have, however, been led to the opposite view. In 1894 to 1896, while on duty at the Torpedo Station or commanding torpedo-boats, I took part in a large number of torpedo attacks, sometimes on one side, sometimes on the other. These exercises were all written up as they occurred, and the reports are well worth printing. They doubtless still exist on file at the Torpedo Station. As the result of many trials, it was found that the average distance of discovery by the use of search-lights in all sorts of weather was

781 yards, figures which are not sensibly different from those given in the case of the Nashville, not using the search-light. A curious result of the Newport experiments was that on bright moonlight nights the boats got closer to the search-lights than they did on dark nights. Moreover, the Newport observers were trained by long practice, those aboard the Nashville were selected for the occasion only. Had the conditions been reversed, the results would, to my mind, have been largely in favor of the carefully selected and carefully trained lookouts, not less than eight for each ship, provided with efficient night glasses; and not in favor of watchers whose eyes are slowly but surely blinded by the mere glare of the search-light beams, constantly played across their view. Search-lights are all right to illuminate fixed sectors of defense, but they should be operated from another point than that in which is located the battery, afloat or ashore, that covers the sector with its guns. Such was their use at Santiago, and the principle may always be applied in similar cases.

If defense nets and search-lights are not to be depended upon, what is left? The answer is, the destroyer. For this purpose there will probably be needed two destroyers for every battleship. With the fleet cruising at a moderate speed, lights out, good lookouts with glasses, and the destroyers ahead, on the flanks, and in the rear; all has been done that seems possible to keep off these little pests; and they will get through on occasions, these means or any other, notwithstanding.

As to torpedoes in ships, so far as I have seen in Europe, there is not the slightest tendency to omit them. Foreigners seem to attach more importance to torpedoes than we do, and yet apparently, in power and accuracy, our latest weapon is superior to theirs; I refer to the turbine torpedo. If a time comes when any foreign nation is thinking of abandoning torpedoes in ships, that will be the time for us to install more of them. Lieutenant Hill deserves credit for bringing this question to the Department's attention. An argument in favor of torpedoes in ships that is not often stated is this: Supposing that in a fleet action neither side has any intention of coming within torpedo range. A fleet of twelve ships in column at distance covers 4400 yards, a good range for the batteries is from 1500 to 2500 yards, torpedo range is at least 1000 yards and increasing, ships at 12 knots move 120 yards in 3 minutes. In the conscious or unconscious mix up of these distances in the effort on the part of one or the other commander to secure good tactical positions, the end units are without doubt often going to find themselves within the required 1000 yards of some part of the enemy's line. The ship that has no torpedoes in these circumstances has not been designed to fulfil the tactical conditions.

LIEUTENANT E. E. CAPEHART, U. S. Navy.—I have always been an ardent advocate of the torpedo, and have believed for many years that it would eventually find a champion who would bring it to the fore and impress its value on the service. I agree entirely with Lieutenant Chandler in all that he says of the weapon, and trust that his exposition of the value of it may have a lasting and beneficial effect on all who may have heard his lecture or who may read it.

His remarks in regard to the necessity of taking good care of the torpedo are decidedly pertinent, as I have seen many good outfits of torpedoes deteriorate into worthless weapons on account of the weak belief of those in charge, badly instructed crews, and indifferent care. To get good results one must have a constant and watchful care over the entire outfit of torpedo material as supplied to our ships, and when this has been accomplished, a well drilled crew will make the unbeliever change his mind.

I am so favorably inclined toward the installation of these outfits in our new ships that all I could say would be to urge the service to unite in advocating it.

LIEUTENANT W. C. DAVISON, U. S. Navy.—After having carefully read Lieutenant Chandler's article on "Automobile Torpedoes; their Use and Probable Effectiveness," I agree thoroughly with Lieutenant Chandler in every statement of fact and opinion in this article. In my opinion the following facts should be emphasized:

(a) That, with proper care and handling, the modern torpedo is very reliable.

(b) That, when in proper condition, it is, within its range, more accurate than a gun.

(c) That it is not a very difficult matter for experienced men to keep torpedoes in perfect condition.

(d) That, in order to secure the best results, every vessel carrying torpedoes should have a torpedo division composed of a few men, selected as carefully as gun-pointers are selected, instructed as carefully, and exercised as often.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

HISTORICAL INSTANCES OF SCOUTING.*

By Captain C. F. Goodrich, U. S. N.

History is full of the crying need of scouts. Howe in 1778 was particularly well served in this respect. He had timely information from the South that D'Estaing had appeared off the Virginia coast and he was, in consequence, able to complete his part in the change of front from Philadelphia to New York with the certainty of being in advance of his enemy at the Hook.

In 1781, Graves at New York was in ignorance of De Grasse's advance on the Chesapeake and was amazed, on arriving off the Capes, to find De Grasse's fleet at anchor in Lynn Haven Bay. His scouts had been ordered to keep under way off the bay, but they failed to do so and were at anchor when De Grasse appeared. One was captured and the other driven up York River. Through misconduct of his scouts, Graves was surprised by a strategic move that practically ended the war.

Nelson's chase after the French fleet bound to Egypt is especially instructive on account of his own expressed views on this subject. The words of this master of the art of naval war should not be lightly neglected.

To Sir William Hamilton, June 12, 1798, off Elba, he wrote:

"* * * * If it is convenient I much wish for some frigates and other fast sailing vessels, for by a fatality all mine have left me."

To same, June 17, Naples Bay:

"In my present state if I meet the enemy at sea, the convoy will get off for want of frigates."

*Lecture delivered by Captain C. F. Goodrich, U. S. N., at the Naval War College, Newport, R. I., July 30, 1902.

To Lord St. Vincent, June 29, off Alexandria:

"On June 15th I made Ponza Islands, where, not finding a cruiser, I sent Capt. Troubridge in the *Mutine* to talk with Sir William Hamilton and Gen. Acton and to state my distress for frigates."

Again in discussing the destination of Bonaparte he says:

"Here I had deeply to my regret my want of frigates and I desire it to be understood that if one-half of the frigates your lordship has ordered under my command had been with me, that I could not have wanted information of the French fleet."

To Lord St. Vincent, July 12, 12 leagues west of Candia:

"I have again to deeply regret my want of frigates, to which I shall ever attribute my ignorance of the situation of the French fleet."

To same, July 20, from Syracuse:

"Every moment I have to regret the frigates having left me, to which I must attribute my ignorance of the movements of the enemy. Your Lordship deprived yourself of frigates to make mine certainly the first squadron in the world, and I feel I have zeal and activity to do credit to your appointment, and yet to be unsuccessful hurts me most sensibly."

Nelson to Sir William Hamilton, August 9, 1798:

"I have intercepted all Bonaparte's despatches going to France. This army is in a scrape and will not get out of it."

Nelson to Lord Howe, August 9:

"Was I to die this moment, 'Want of Frigates' would be found stamped on my heart. No words of mine can express what I have and am suffering for want of them."

The French disaster at the battle of the Nile cannot be attributed to lack of scouts. Admiral Brueys deliberately selected his position and thought it secure. That he was unaware of Nelson's approach until too late to weigh and steam to sea is not pertinent. He decided to meet the attack at anchor while there was yet time to weigh, and in spite of the pleading of his third in command, Blanquet du Chayla.

A very amusing instance of how not to do a thing is found in the *Tacony* episode of 1863, described in the PROCEEDINGS OF THE NAVAL INSTITUTE, Whole No. 86, June, 1898 The *Tacony*, it will be remembered, spent two weeks off our coast, burning and destroying with that impunity which seems to wait upon the auda-

cious, and although a sailing vessel and chased by forty odd steamers sent out in hap-hazard fashion, she evaded detection. The account referred to, with its charts, belongs properly at this point in our study of the general subject, and should be consulted at your leisure.

If what has already been said has convinced you that scouting is an operation of some moment in warfare, even if you are not persuaded to share my belief that it is second in importance only to the shock of armored squadrons, you will doubtless also share the interest with which I have asked the question, "What part did the scouts play in our late war with Spain?"

In the first place how many scouts properly so-called were there? Remembering that the North Atlantic fleet counted some thirty regular men-of-war, not including torpedo boats, and that about one hundred vessels were acquired from the merchant marine, the Revenue Service, the Light House Establishment, etc., it will seem odd, to say the least, to be told that of this whole number only five were especially employed for the purpose of finding out where the enemy was. These five were the *Columbia,* which cruised off the coast of New England and the Middle States; the *Minneapolis,* which cruised off the New England coast until the 4th of May and which started south on the 13th of that month; the *St. Louis, Harvard* and *Yale,* which proceeded at once to the West Indies. A large proportion of the auxiliaries were assigned to harbor patrol; some were tugs, colliers, etc.; but after making due allowance under this head the fact remains that we were much more anxious to increase our fighting strength than we were to locate the enemy. It is proverbially easy to be wise after the event. In the light of this wisdom we may confidently assert that Admiral Sampson was sadly deficient in scouts and that his squadron would have been more formidable had the *St. Paul, Badger, Dixie, Panther, Yankee, Prairie, Mayflower, Yosemite,* been hurriedly fitted with a few 6-pdrs., as were the *Yale, Harvard* and *St. Louis,* and sent to ascertain the whereabouts of Cervera's ships.

There were on Cervera's part of course two possible objectives, an offensive descent upon the Atlantic seaboard (most unlikely), and a movement towards Cuba for the defense of that island, and the scouts were despatched in accordance with this dilemma. As

I am happily ignorant of the author or authors of the scheme of scouting adopted, I can discuss that scheme impersonally. I think even the traditional schoolboy will recognize the soundness of the general distribution of the five vessels assigned to this work and will chiefly criticize the inadequacy of their numbers. It was indeed simply impossible to scout satisfactorily with so few ships. A glance at the map will at once reveal the insufficiency of the force employed. The three passes between Antigua, Guadaloupe, Dominica and Martinique were patrolled, but the four equally important ones to the northward of Antigua and between Martinique, St. Lucia, St. Vincent, and between Grenada and Tobago were left unguarded. There were in fact seven passes, requiring seven ships at least to watch them, and but two vessels were assigned to this duty. An eighth, cruising to the northward of the Virgin Passage, was likewise needed (this work fell to the *Yale*) as well as two (one of them to keep touch and the other of great speed to run in and report) at the eastern entrance of the old Bahama channel to meet the contingency of Cervera's going to Havana via the Crooked Island Passage. Ten vessels, not counting reliefs, would seem to have been demanded.

Who is responsible for this inadaquacy I cannot pretend to know, but, in my judgment, the responsibility is very grave. At the outset, I must think, scouts were more necessary than auxiliary cruisers. After Cervera had been found on the high seas and smashed, as he would have been, these scouts could have been turned into auxiliary cruisers for blockading purposes had there been any continuation of the war.

But before proceeding further in our study let us see just what was actually done. As in the case of the *Tacony*, I will show by diagrams where were the scouts and the North Atlantic Fleet at noon of each day during the month of May, 1898, and also where was Cervera (see maps).

The cruising limits of the *St. Louis* and *Harvard* were fixed by these orders of the Navy Department:

WASHINGTON, April 29, 1898.

Sir:—The Department intends to employ you to ascertain whether the Spanish fleet, which was lately at the Cape de Verde Islands, intends moving upon the West Indies, and if so, to what locality.

For this purpose you will proceed with the U. S. S. *Harvard* under your command, immediately to the eastward of the Windward Islands and cruise on a line extending between lat. 15 38 N., long. 59 40 W., and lat. 14 25 N. and long. 59 30 W.

If you get no positive information by noon of May 10, you will proceed to touch at the chief ports of the island of Martinique, for the purpose of obtaining information of the Spanish fleet in case it should have passed you without your knowledge, and if you obtain what you consider to be reliable information as to its presence in the West Indies, you may if advisable proceed to that vicinity to get confirmatory evidence, being careful, however, not to thus sacrifice time that might be better employed in giving notice to the commander-in-chief in Cuban waters and to the Department, as mentioned in Section 4.

If you should find the Spanish fleet is approaching, or has entered the West Indies, you will telegraph the Department and also the commanding officer at Key West for transmission to the commander-in-chief on the coast of Cuba, or wherever he may be at that time. You will then proceed, with your ship, either to observe and keep touch with the Spanish fleet, or to personally inform the commander-in-chief, either off Havana or wherever he may be at the time.

The Department relies upon your discretion as to whether it would be best to observe the Spanish fleet, or to proceed to personally inform the commander-in-chief that it has entered the West Indies.

If the Spanish fleet enters the West Indies, and you have informed the commander-in-chief on the station, you will, if he so requires, proceed to act in accordance with his instructions, in further observing or getting intelligence of said fleet. If he does not require such service, you will proceed to a port where there is telegraphic communication, inform the Department and wait twenty-four hours, after which, if you get no instructions, proceed to Hampton Roads, Va.

In case you should get no reliable intelligence of the Spanish fleet being bound to the West Indies, or if you obtain reliable intelligence of its movements or destination elsewhere, you will so telegraph the Department and the commander-in-chief on the station, after which you will wait at the same place twenty-four hours for orders from the Department, and if not received, proceed to Hampton Roads, Va.

For your information there is inclosed a copy of the orders sent to the commanding officer of the U. S. S. *St. Louis,* who is directed to cruise on a line in extension to the one assigned to you. One of the American liners has been detailed to cruise around the island of Porto Rico.

A copy of your orders has been sent to the commander-in-chief of the North Atlantic Station.

In case of capture you will, without fail, destroy or sink these instructions, as well as any publications of a confidential nature.

It is very important that you should, if possible, make 336 miles per day on the passage from New York to your cruising ground.

Very respectfully,

(Signed) JOHN D. LONG, Sec.

Capt. C. S. Cotton, U. S. N., commanding U. S. S. *Harvard.*

Captain Goodrich's orders were identical except that the

St. Louis was to cruise on the northern prolongation of the Harvard's line and to go to Guadaloupe after noon of May 10.

The two ships, by Capt. Cotton's order, met at noon and midnight at the middle point of the patrol line which was only 150 miles long, practically 75 miles for each ship four times a day in a run of 300 miles. Had the total line been only 50 miles and the time one day longer Captain Cotton would have discovered Cervera on the afternoon of May 11.* I presume in that case he would have told me to keep touch with the Spaniards while he hurried into port to cable the news home and, on the 12th, Sampson would have taken station in or near the Mona Channel to intercept Cervera. On such slight chances do great issues hang. As it was, Capt. Cotton, to whom is undoubtedly due the credit of first reporting Cervera's presence in the West Indies, suffered the mischance of having his telegram delayed in Martinique. It will be remembered that after his anchoring at St. Pierre, certain of the Spanish vessels made their appearance off the island and the French local authorities forbade his leaving until the lapse of the conventional twenty-four hours after the Spaniard's departure.

It was at Martinique, by the way, that Cervera heard of the attack on San Juan, Porto Rico, news which had its weight in the determination not to go there but to look for the coal promised off Curacao.

The orders to Captain Wise, of the *Yale*, were, generally speaking, of like tenor, but they sent that ship to the neighborhood of Porto Rico, as will be seen.

NAVY DEPARTMENT, WASHINGTON, May 1, 1898.

Sir:—The Department intends to employ you to ascertain whether the Spanish fleet which sailed from the Cape de Verde Islands on the morning of April 29 intends moving upon the West Indies, and if so, to what locality.

For this purpose you will proceed, with the U. S. S. *Yale*, to the Island of Porto Rico, and will cruise around that island, at a suitable distance from shore, until the evening of May 13. If you think prudent, you will approach and observe the harbor of St. John's, and also other harbors, sufficiently to ascertain whether the said Spanish fleet or any considerable body of their men-of-war are assembled in said ports.

If you get no positive information by evening of May 13, you will proceed to St. Thomas, or to any other island where you think it probable that you might obtain information of the Spanish fleet, in case it should have passed you without your knowledge.

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* When Cervera's squadron passed about 23 miles south of Captain Cotton's southern limit.

Whatever conclusion you may arrive at regarding its whereabouts and movements, you will telegraph it to the Department. If you find the Spanish fleet is approaching or that it has run into any harbor of Porto Rico, you will, if judicious, telegraph the Department and also to Key West, and you will then proceed, with your ship, and personally inform the commander-in-chief of the North Atlantic Squadron of the arrival of the Spanish fleet.

The Department relies upon your discretion as to whether it would be best to first telegraph the commander-in-chief and the Department or to proceed at once to inform the commander-in-chief that the fleet has entered the West Indies, bearing in mind that it is very desirable to telegraph first if possible.

If you do not sight the Spanish fleet, or hear of its going to the West Indies, or should you obtain reliable information as to its movements or destination elsewhere, you will inform the Department and the commander-in-chief by telegraph, after which you will wait at the same place twenty-four hours for orders from the Department, and if none are received you will proceed to Hampton Roads.

If the Spanish fleet enters the West Indies, and you have so informed the commander-in-chief on the station, you will, if he so requires, proceed to act in accordance with his instructions, in further observing or getting intelligence of the movements of said fleet. If he does not require this service, you will proceed to a port where there is telegraphic communication and inform the Department that you are there awaiting orders. Remain there twenty-four hours, and if none are received you will proceed to Hampton Roads.

There are a couple of "lookout ships" cruising between lat. 14 and 17, on a line about 100 miles to the eastward of Martinique and Guadaloupe. These ships are the U. S. S. *St. Louis* and *Harvard*.

A copy of your orders has been sent to the commander-in-chief of the North Atlantic Station.

In case of capture you will, without fail, destroy or sink these instructions, as well as any publications of a confidential nature.

Very respectfully,

(Signed) JOHN D. LONG, Sec.

Commanding Officer U. S. S. *Yale*.

The *Minneapolis* was moved by telegraphic orders which increase in intensity of tone towards the last and reflect a solicitude which the public, now calm, but then terror-stricken, will have difficulty in explaining.

WASHINGTON, April 23, 1898.

SCHLEY, Fort Monroe.

Send *Minneapolis* immediately to Eastport, Me., skirting coast above Cape Ann; *Columbia* to Newport, R. I. Both will receive upon arrival further orders.

(Signed) LONG.

WASHINGTON, May 13, 1898.

Minneapolis, Fort Monroe, Va.

Proceed with all possible dispatch at utmost speed to cruise between Monte Cristi Is., Haiti, and Caicos Bank, Bahamas, to watch for the Spanish fleet, which was off west coast of Martinique Island, W. I., on May 12. If sighted, or if you get reliable news, telegraph Sampson at Key West, Fla., and the Department; then follow the Spanish fleet and report their destination. If you learn nothing after four days on station, proceed to Cape Haitien, Haiti, and telegraph Sampson at Key West, Fla., and the Department. The *St. Paul* will cruise between Morant Point, Jamaica, and west end of Haiti. Your orders must be kept secret absolutely, even from your officers.

(Signed) LONG.

WASHINGTON, May 15, 1898.

Supply (care American Consul), Cape Haitien.

Cruise between Caicos Bank and Monte Cristo Island until you fall in with *Minneapolis*, due there 16th and 17th, and transmit to her commander following cipher message, after which proceed to Key West, distributing supplies to blockading squadron en route.

Spanish squadron off Curacao May 15. Believed going to Gulf of Venezuela to coal. Proceed with all possible dispatch to that vicinity; get and keep touch Spanish fleet. Care must be taken to avoid capture. *Harvard* and *St. Paul* have been ordered upon this duty. If not able to find enemy, communicate by telegraph nearest station.

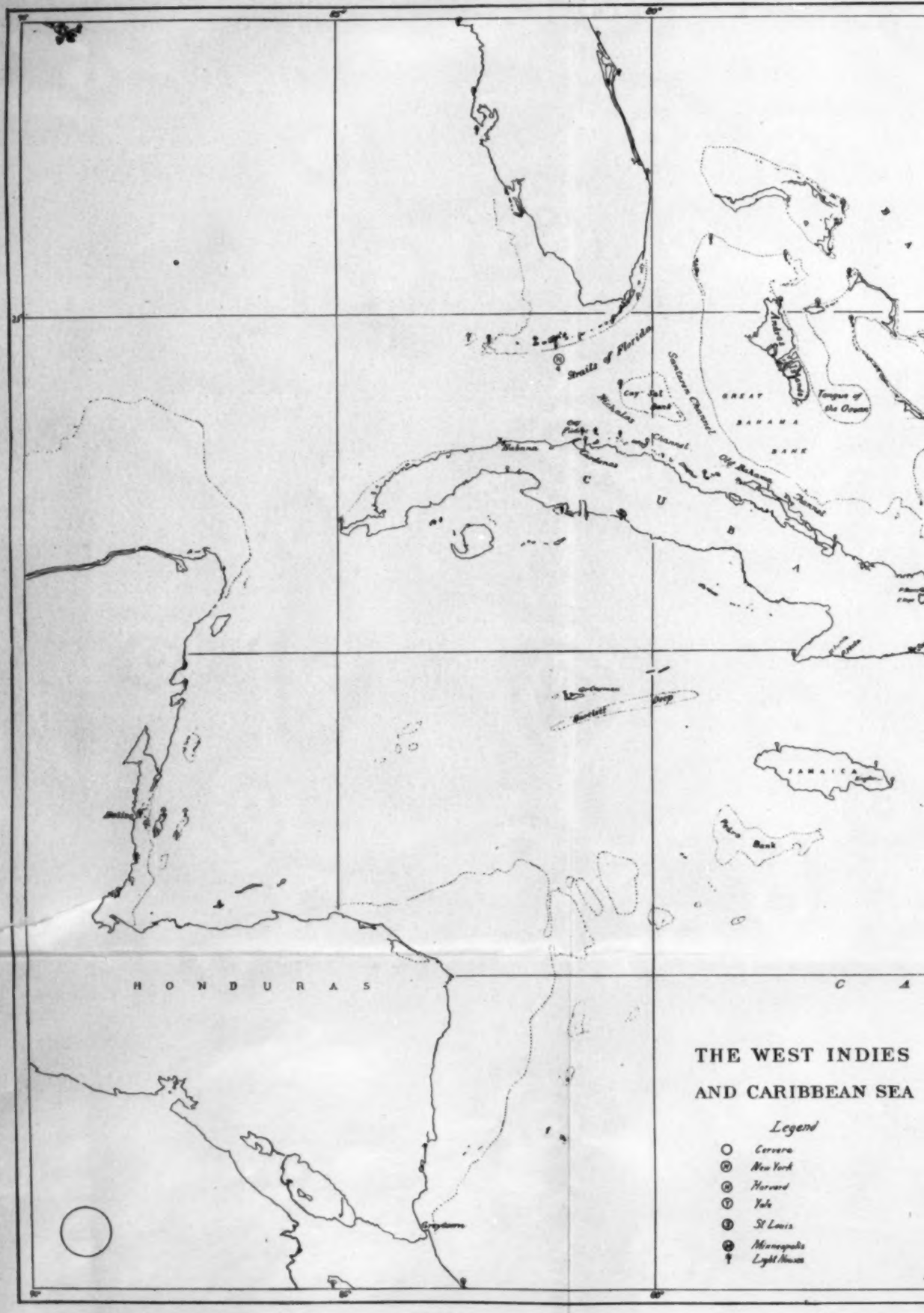
(Signed) LONG.

I think it must be admitted that the general scheme of scouting was sound up to May 12th, and justified by the *Harvard's* success in sighting and reporting Cervera, but it is exactly at this point that the insufficient number of scouts began to tell. Although Cervera was known to be in the West Indies, Sampson had no suitable vessels to despatch after him and so it was that the doubts as to the latter's objective clouded the events of the next fortnight and led to occurrences which we must all deplore. Had Sampson possessed, besides the three American liners, the eight other steamers already mentioned, he would have been fairly strong where he was lamentably weak, and I think we may state that proper use would have been made of that strength and the issue between him and Cervera settled before the latter could reach a Cuban or Porto Rican harbor.

It may be too soon after the events with which we are concerned to inquire to what extent the commander-in-chief controlled the movements of the scouts, or to praise or blame this

control, but the tenor of the Department's orders to the *Harvard* and others would seem to imply that the initial movements of the scouts were regulated in Washington. I have been so consistent in my pleadings that absolute authority should be granted an admiral that I am but reaffirming a position always held when I suggest that Sampson would have done far better had the whole responsibility been left unreservedly with him. With this contention I cannot believe that any student of history or any naval officer possessing even the crudest realization of the connection between responsibility and authority, will fail to agree. I conclude this lecture with an earnest appeal for a right conception of a commander-in-chief's duties and the prayer that in any future war our admiral be granted that free and absolute control without which it were ungenerous folly to hold him accountable for results.

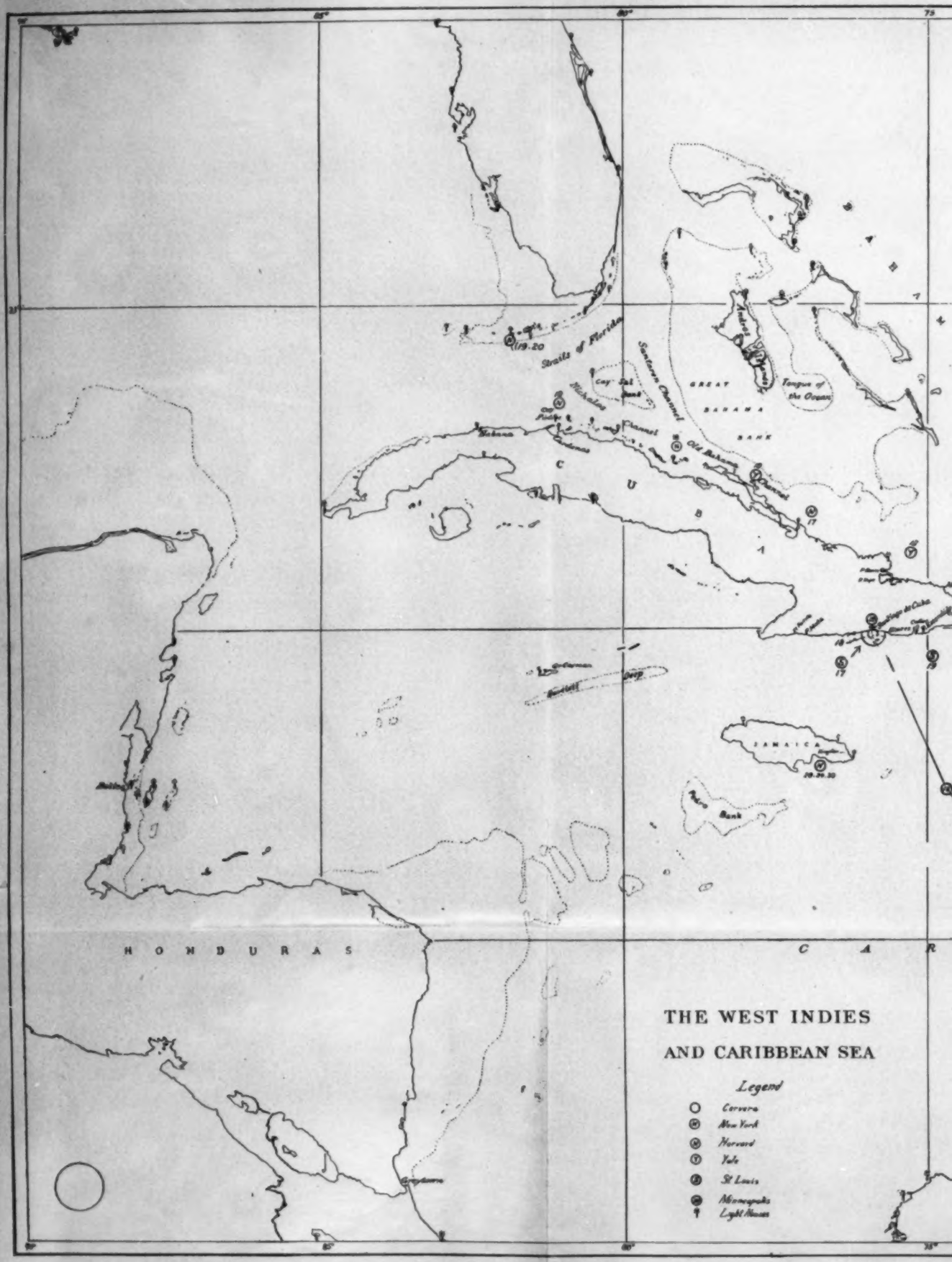
THE POSITIONS OF THE NORTH ATLANTIC FLEET AND THE SCOUTS, MAY



COUTS, MAY 4TH TO 11TH, 1898, INCLUSIVE.—NOTE THOSE OF THE FLEET ARE ESTIMATED IN SOME CASES.

INDIES

BEAN SEA


Straits of Florida
Santaren Channel
GREAT BAHAMA BANK
Tongue of the Ocean
Old Bahama
CUBA
JAMAICA
HONDURAS
THE WEST INDIES
AND CARIBBEAN SEA
Legend
Cornell
New York
Harvard
Yale
St Louis
Minneapolis
Light House

LEET, THE SCOUTS, CERVERA'S SQUADRON, FROM MAY 12TH TO 20TH, 1898.

THE POSITIONS OF THE NORTH ATLANTIC FLEET, THE SCOUT

T, THE SCOUTS, CERVERA'S SQUADRON, FROM MAY 20TH TO 31ST, 1898.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NATHANIEL BOWDITCH.

By LIEUT. G. W. LOGAN, U. S. Navy.

To thousands of seafarers the *American Practical Navigator* is an everyday acquaintance; yet few can tell more of its author, Nathaniel Bowditch, than that he wrote, a long time ago, a remarkable compendium of nearly all the knowledge that is required in guiding a ship from place to place. The life and works of this wonderful man are worthy of being better known.

Nathaniel Bowditch was born on the 26th of March, 1773, at Salem, Mass., where his family had resided since the earliest settlement of the place. His ancestors for four generations back had been shipmasters; his father, however, meeting reverses early in life, had abandoned the sea and was reduced to gaining a livelihood by following the trade of a cooper. At the age of ten years, Nathaniel began to earn his own living in his father's shop, terminating a school career that had only just begun. After a short time he left the cooper shop and was entered as a clerk or apprentice at a ship-chandler's.

From earliest childhood he evinced a marked fondness for study, particularly the study of mathematics, and he continued to improve every opportunity for cultivating his mind, even after all hope of regular schooling had ceased.

In 1795, Bowditch went to sea, and from then until 1804 he made five voyages—the first as clerk, the next three as supercargo, and the last as master and supercargo; on these voyages he visited Mediterranean and other European ports, the East Indies, and the Philippines.

While at sea, Bowditch devoted unremitting study to navigation, and imparted instruction in that science to all on board of his various vessels—officers and crew. It is related that on his fourth voyage—to Manila—every one of the crew of twelve men "could take and work a lunar observation as well, for all practical pur-

poses, as Sir Isaac Newton himself were he alive" and on one of his ships even the colored cook became proficient in lunar distances.*

In 1799 there appeared the first American edition of the *New Practical Navigator,* a work by an English author named John Hamilton Moore, prepared for publication in this country by Nathaniel Bowditch. This quickly ran through a first and a second edition, and was ready for a third, when its scope was altered and a new work was published in its place—Bowditch's *New American Practical Navigator,* which we know to-day. An extract from the preface to the original edition—issued in 1802, one hundred and one years ago, and printed with the quaint *f*-shaped *s* and connected *ct* of other days—will tell the story of its origin:

This work was originally intended for a third American edition of the Practical Navigator of John Hamilton Moore, which had already passed through two large impressions in this country; but on a careful examination of that treatise, it was found so erroneous in the tables, and faulty in the arrangement, that it was concluded to take up the subject anew, and, without being confined to Moore's work, to have recourse to those authors whose writings would afford the best materials for the purpose—to introduce such additions and improvements of our own as a close attention to the subject suggested—and to ensure the accuracy of the Tables, by actually going through all the calculations necessary to a complete examination of them. From these labors has resulted the work now offered to the public. The particulars in which it differs from other works of the kind will be briefly stated, after giving a short account of the most popular treatises of Navigation.

The most complete treatise we are acquainted with is called the "Elements of Navigation," by John Robertson, published at London in 1750, in 2 vols. 8vo.; it contains the demonstration of most of the theorems of navigation, with many practical examples, arranged in a natural order, but the collection of tables is very incomplete. The "Requisite Tables," published in 1766, 1781 and 1799, by Dr. Maskelyne, the present Astronomer Royal at Greenwich, who has rendered such important services to navigation by his various publications, contained nearly all that was wanting in Robertson's work so that both of them combined formed a complete system of navigation, both in theory and practice, but singly neither of them was complete; and much of Robertson's work was useless to most seamen, who in general care but little for the demonstrations of the rules they work by. Moore, noticing this circumstance, resolved to make his work on a different plan, to contain only such matter as might be useful to the mere prac-

* Time changes all things. In a recent revision of Bowditch's *American Practical Navigator* the lunar distance problem was relegated to an appendix, and only just escaped complete elimination.

tical navigator. To effect this, he copied most of the practical rules of Robertson, and the tables of Maskelyne, and formed a treatise, of moderate size and price, called "The Practical Navigator," which had a great run in England and America, but rather from the principle of its construction, than from the execution of the work, which in many instances was extremely faulty, for, without correcting any errors in the works he copied from, he added many of his own, one of which has been fatal to several vessels. The error alluded to is that in the tables of declination, which was corrected by the author of this work in the first and second American editions. In addition to these faults of Moore's work, it may also be mentioned that he abridged some of the tables and neglected others of great importance. To remedy this defect, the author of this work has added forty-four pages to the tables used by Moore, and re-calculated the whole of them, making the last figure exact to the nearest unit, a circumstance very conducive to the accuracy of any calculation. In performing this, no less than *eight thousand* errors were discovered and corrected in Moore's work, and above *two thousand* in Maskelyne's Requisite Tables. Most of the errors in Maskelyne's collection were in the last decimal place, and the corrections in many instances would but little affect the result of any nautical calculation; but when it is considered that most of these tables are useful on other occasions, where great accuracy is required, it will not be deemed a useless improvement to have corrected so great a number of small errors.

The author had once flattered himself that the tables of this collection which did not depend on observations would be absolutely correct, but in the course of his calculations he has accidentally discovered several errors in two of the most correct works of the kind extant, viz., Taylor's and Hutton's Logarithms, notwithstanding the great care taken by those able mathematicians in examining and correcting them; he therefore does not absolutely assert that these tables are entirely correct, but feels conscious that no pains have been spared to make them so. Any one who wishes to examine these calculations may do it by the formulæ used for this purpose, which will now be given with some additional remarks.

Then follows an explanation of the various tables, and under Table V, giving the sun's declination for various years, we read more of the error in Moore's work previously referred to:

"This table is one of the most important in this collection, because the latitude is generally determined by it; it was therefore a very criminal inattention of Moore in publishing it so incorrectly in most of the late editions of his work, for by reckoning the year 1800 as leap-year, he had made an error of 23 miles in some of the numbers. This error was the cause of losing two vessels to the northward of Turk's Island, and bringing others into serious difficulties."

In an advertisement of the publisher—Edmund M. Blunt, of Newburyport, Mass.—a little sarcasm is indulged in at the expense of John Hamilton Moore. To quote again:

The decided preference given the American editions of the "New Practical Navigator," since its appearance in 1799, calls on the proprietor for his acknowledgments of gratitude. To the honor of the American mariners, and through the good offices of the American booksellers, be it said, that within two years seven thousand copies have been sold in the United States. He was preparing to put a third edition of the same work to press, but has since been induced to relinquish Moore's treatise for the present more correct and perfect work, furnished by Mr. Bowditch.

While he is tendering his thanks to such as have assisted in the establishment of the work, it would be highly criminal to omit those due to John Hamlton Moore; and with the greatest frankness it is acknowledged that he contributed largely to its establishment, as his late editions have been so erroneous that no person would hazard his interest, much less life, in navigating his vessel by the rules there laid down, and it is well known that in all the English West India Islands the American edition has invariably been purchased when a supply could be obtained.

Bowditch retired from the sea in 1804, and devoted the rest of his life to the business of insurance—at first in Salem, and afterwards in Boston. He found leisure, however, to continue his studies and published a number of essays and miscellaneous papers—relating mostly to mathematics or astronomy. But by far his most important work was the translation of the *Mécanique Céleste* of La Place, with copious notes which far enhanced the value of the original; this covers four huge volumes, each of which suggests, in size, the family Bible or the unabridged dictionary; alongside this stupendous work, the computation of a book of navigation tables is insignificant, and it is remarkable that these volumes could result from the labor of leisure hours during only a part of a lifetime.

Dr. Bowditch died March 16, 1838, at the age of sixty-five, laden with honors from his fellowmen and leaving a record of wonderful achievement during a life of stainless integrity. Of many eulogies written and spoken of him, that of the Salem Marine Society will appeal most strongly to seamen:

In his death a public, a national, a human benefactor has departed. Not this community nor our country only, but the whole world has reason to do honor to his memory. When the voice of eulogy shall be still, when the tear of sorrow shall cease to flow, no monument will be needed to keep alive his memory among men; but as long as ships shall sail, the needle point to north, and the stars go through their wonted courses in the heavens, the name of Dr. Bowditch will be revered as of one who helped his fellowmen in time of need, who was and is a guide to them over the pathless ocean, and one who forwarded the great interests of mankind.

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WAR SIGNALS.

By COMMANDER BRADLEY A. FISKE, U. S. N.

The United States Navy has adequate means for making signals for the routine duties of a fleet. It has adequate means for signalling "vessels right" for fleet parades. It has wireless telegraph outfits in many ships, by which signals can be sent and understood fifty miles—unless the enemy is about.

Is this all we need? What could we do if we tried to handle a great fleet in war: the kind of fleet that we should have to handle against a great enemy fleet? Could an admiral handle it by means of flags and wireless telegraphy?

If he could, we can go ahead and organize our fleet, and feel that it can be handled like a football team.

If he could not, is it not time to devote a little time and thought to the matter?

Is this so small a matter—this handling of the great fleet we are getting—that we can afford to neglect it?

The adoption by various Navies of Wireless Telegraphy has impressed some people with the notion that it solves the problems of War Signalling. Of course this is not so. The analogy between the transmitters and receivers of wireless apparatus on the one hand, and steam whistles and human ears on the other hand, is not very remote; and it would be fully as difficult to handle a fleet in war by steam whistles as by Wireless Telegraphy, —even if guns were not making a noise. For, while the automatic recording apparatus of Wireless Telegraphy gives it a great advantage over the non-recording human ear, yet the steam whistle of the flagship could not be "interfered" with by the enemy's ships, while her wireless transmitter could be made entirely useless. It is a scientific fact that, even if Wireless Telegraphy could

be made syntonic, the enemy could soon discover the tone and imitate it, even if he could not read the signals; or, he could "mutilate" the signals by sending out waves from transmitters of adjustable capacity. Besides, what admiral is going to fill the ether with Hertzian waves, and make a present to the enemy of the information that he is near? The end in view must be very great to justify such a risk, which would be much greater than the risk involved in signalling with the Ardois or with search-lights. In view of these facts, may we not very seriously ask the question, "Has Wireless Telegraphy any military usefulness whatever? And may not the very convenience of its use in peace betray us into the *pernicious* habit of handling our war fleet in peace by a means that would be worthless in war?"

Another reason why attention is not given to war signals is a vague feeling in the minds of some officers that a navy does not need any so-called "battle signals;" that it needs simply a system of "follow my leader" maneuvers. Perhaps careful reflection will convince these officers that, although every important navy believes that a system of "follow my leader" maneuvers is necessary as a "stand by," yet—

(1) The number of practicable "follow my leader" maneuvers is extremely small.

(2) All of them need a tremendous amount of fleet drill for their safe execution, and even then are exceedingly dangerous, and should be used, in battle, only when all other means fail. We must not sink our own ships in battle by collisions caused by misunderstandings: one such collision between battle ships would lose us the fight.

(3) This remark does not apply to change of direction in column, when the flagship leads. But the flagship should never lead the column in battle with a modern enemy, because the enemy would concentrate his gun-fire on her, and disable her, and leave the fleet without a head.

(4) If "battle signals" mean signals made during actual interchange of gun-fire, and even if it be granted that a navy does not need battle signals for that critical time, does she not nevertheless need the very best and quickest means of signalling *when maneuvering for position before the actual battle begins?* No fleet of ours should ever be forced into battle (except under peculiar circumstances) if caught in a position where it would fight the battle under disadvantageous conditions, such as—

a. With the sun in the eyes of the gun-pointers.

b. From leeward.

c. Between the enemy and the shore.

d. With the various squadrons unconcentrated, or not in the most desirable formations, or in positions unfortunately placed with reference to each other.

It is possible that two great fleets, coming into each other's presence, may maneuver (jockey) for days, each one trying to get such a position as will enable it to fight with the advantage on its side. This often has happened with armies, and it has happened also between French and British fleets in the West Indies. The advantage of position is such a valuable thing, that great battles have been precipitated by small engagements, that began in an endeavor of both sides to secure it. Now that fleets are becoming so tremendous, they are coming to be like armies of the sea. And in view of the vast issues that will be at stake, when our great fleet meets the great fleet of the enemy, we must not be forced to begin the battle before we have gotten all the advantage of position possible. If an army—or a fleet—meets an enemy in battle with the advantage of position in favor of either side, the result of the battle will, in most cases, already be determined. Many of the great battles of history have been decided before they were fought out—as instanced especially in the battles of Napoleon and Von Moltke. And, in the case of Kitchener, it has been said that he has never taken much interest in his battles themselves, thinking them rather vulgar and quite unnecessary; because he has always gotten his forces into such positions before he let a battle begin, that the result was predetermined.

From this point of view, the point of view of getting a *great fleet* into an advantageous position with an enemy who will try to out-jockey us, do we not need a rapid and accurate means of signalling?

In order to answer this question wisely, it must be borne in mind that we shall not have to handle a *few* ships, but an enormous fleet, composed of separate squadrons of battleships, armored cruisers, protected cruisers, scouts, destroyers, ammunition ships, hospital ships, supply ships and colliers. It must be borne in mind that the number of possible combinations of conditions of weather, sea, time of day, number and kinds of ships on each side, proximity of land, amount of ammunition on hand and expended in

battle, speed, etc., is well-nigh infinite. It must be borne in mind that the number of unforeseen conditions and events that may occur is far beyond poor human foresight.

Obviously, modern fleet handling is becoming a complicated thing. This is merely saying that it is following the universal "Law of Evolution." Therefore, a modern fleet-battle will not be a simple "slugging match"; not until the time comes when one admiral, or the other, gets things as he wants them, and makes a rush.

Other things being equal, that admiral will succeed in getting things as he wants them, who has the better means of telling his ships what he wants them to do.

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THE ACCURACY AND PROBABILITY OF GUN-FIRE.

By PROFESSOR PHILIP R. ALGER.

If a great number of rounds are fired from a gun, under as nearly as possible the same circumstances, it will be found that the impacts (which we will suppose to be received upon a vertical screen perpendicular to the plane of fire) are grouped closely together around one point and are more and more widely separated as the distance from that point increases.

The point about which the impacts are most closely grouped is called the *mean point of impact*, and its coordinates with reference to any axes Z, Y,—say the lower and the left-hand edges of the vertical screen,—are simply the averages of the coordinates of all the impacts with reference to the same axes. In other words, the mean point of impact is the center of gravity of the impacts, regarding them as equal masses, and its coordinates are $\frac{\Sigma z}{n}$ and $\frac{\Sigma y}{n}$ where $z_1 y_1$, $z_2 y_2$, &c., are the coordinates of the n impacts.

The trajectory from the gun to the mean point of impact is called the *mean trajectory*, and the divergencies of the trajectories of particular shots from the mean trajectory have a multitude of independent causes, such as,—an initial angular deviation; variations of the muzzle velocity; variations of the form and weight of the projectiles; variations in the angular position of the gun when it is fired, and in its jump; variations in the force and direction of the wind; and variations in the drift due to rotation.

If the actual mean initial velocity is that for which the sights of the gun are graduated; if the range is exactly known and the sights are set accordingly; if the density of the air is standard; and if there is no wind and no motion of gun or target;

then the mean point of impact will coincide with the point at which the line of sight is directed. These conditions, however, are never fulfilled, nor is it possible to exactly compensate for their non-fulfillment, and consequently the mean point of impact is never exactly at the center of the target. To bring it as near as possible to that point is the object of the *regulation of gun-fire.*

For the present we will not concern ourselves with the position of the mean point of impact relative to the target, but will consider only the distribution of the impacts about the mean point of impact.

The deviations of projectiles from their mean point of impact are closely analogous to what are called "accidental errors," —such, for example, as are made in the direct measurement of a magnitude of any kind,—and they obey the same laws. Small deviations are more frequent than large ones; positive and negative deviations are equally probable, and are therefore equally frequent, if the number of shots is great; very large deviations are not to be expected at all (if one occurs, it must be due to some avoidable mistake). We will designate a lateral deviation by Δ_x and a vertical deviation by Δ_y, and we will assume that they are completely independent of one another,—i. e. that any particular lateral deviation is just as likely to occur simultaneously with one vertical deviation as with another. We will also designate the *mean lateral deviation* by γ_x and the *mean vertical deviation* by γ_y, the mean deviation being the arithmetical mean of all the deviations in the stated direction regardless of sign.

The *probability* of a future event is the numerical measure of our reasonable expectation of its happening. Thus, knowing no reason to the contrary, we assign an equal probability to the turning up of each of the six different faces of a die at any throw, and we say that the probability that an ace, for example, will turn up is measured by the fraction 1/6. This does not mean that we should expect an ace to turn up once and once only in every six times, but merely that in a great number of throws (n) one may reasonably expect very nearly $\frac{n}{6}$ aces to be thrown and that the greater n is the more likely it is that the result will agree with that expectation.

If an event may happen in a ways and may fail in b ways, each of the $a + b$ ways being equally likely to occur, the probability of its happening is $\frac{a}{a+b}$ and the probability of its failing

is $\frac{b}{a+b}$, and the sum of these two fractions, unity, represents the certainty that the event will either happen or fail. Thus if the probability of an event happening is P, the probability of its not happening is $1 - P$. For example, since of the 52 different cards which may be drawn from a pack, 13 are spades, the probability that a single card drawn from a pack will be a spade is $\frac{13}{52} = \frac{1}{4}$, while the chance that it will not be a spade is $1 - \frac{13}{52} = \frac{39}{52} = \frac{3}{4}$.

If the probability of one event happening is P and that of another, independent, event happening is Q, then the probability of both events happening is the product of P and Q. For example, the probability of a single card drawn from a pack being a face card is $\frac{12}{52}$, and the chance of its being a spade is $\frac{13}{52}$; therefore the chance of its being either king, queen, or knave of spades is $\frac{12}{52} \times \frac{13}{52} = \frac{3}{52}$.

When we consider the deviation of projectiles, we are no longer dealing with definite numbers of equally probable events, but with values which may be anything whatever between certain limits. We cannot assign any finite measure to the probability that a deviation shall have a definite value because the number of values it may have is unlimited; we can, however, measure the probability that a deviation will fall between certain limits, or that it will be greater, or less, than an assigned quantity.

Suppose, for example, that a very large number (n) of shots have been fired, and that, their lateral deviations having been measured, it is found that m of these deviations are between 2 feet and 3 feet (either plus or minus); then we say, that the probability (in any future trial under similar circumstances) of a single shot having a lateral deviation between 2 and 3 feet is $\frac{m}{n}$. Or if, of the n impacts, q were less than 4 feet to one side or the other of the mean point of impact, we should say that the probability of the lateral deviation of any single shot being less than 4 feet is $\frac{q}{n}$. The following actual case will serve as an illustration, although n is not so large as it should be.

On December 17, 1880, at Krupp's proving-ground, at Meppen, 50 shots were fired from a 12 cm. siege gun at 5° eleva-

tion, giving a mean range of 2894.3 meters. The points of fall being marked on the ground, their distances from assumed axes were measured, and the mean point of impact thus determined. Measuring the lateral deviations from this mean point of impact to the right, 14 were between 0 and 1 meter, 8 between 1 and 2 meters, and 2 between 2 and 3 meters; to the left 13 were between 0 and 1 meter, 8 between 1 and 2 meters, and 5 between 2 and 3 meters, and the mean deviation was 1.07 meters. Taking horizontal and vertical axes through the mean point of impact; laying off equal spaces to left and right of the origin, each representing one meter; and constructing on each space a rectangle whose height represents, on any convenient scale, the number of shots whose lateral deviation was within the limits corresponding to the space, we obtain Fig. 1.

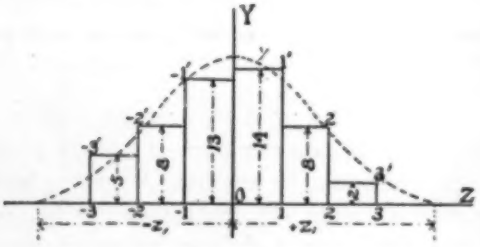

Fig. 1.

It will be seen that the distribution of the deviations is fairly symmetrical to the Y axis, there being 26 to the left and 24 to the right; also that the maximum does not exceed three times the mean deviation; also that the area of each rectangle divided by the whole area of the figure is the measure of the probability (as defined) that any single deviation will fall within the limits represented by its base. Thus area O $11' = 14$, divided by total area $= 50$, is the probability $= \frac{14}{50}$ of any single deviation being between 0 and $+1$ m.; area $11' - 1 - 1' = 27$, divded by total area $= 50$, is the probability $= \frac{27}{50}$ that any single deviation will be between $+1$ m. and -1 m.; and the total area $= 50$, divided by itself, is the probability $= \frac{50}{50} =$ certainty that no deviation will exceed 3 m.

If now the number of shots is increased, while the width of the horizontal spaces is diminished in the same proportion, the area of each rectangle divided by the whole area of the figure will continue to measure (with increasing accuracy) the probability of a deviation falling within the limits represented by its base. At the limit, when the number of shots is infinite and the width of the horizontal spaces has been reduced to the infinitesimal dz, the height (y) of each rectangle will still be finite; the upper contour of the figure will become a curve approximately like that shown as a dotted line; the area of each rectangle (now become the elementary area ydz) divided by the whole area under the curve $\left(\int_{-z_1}^{z_1} ydz\right)$ will still measure the probability that a deviation will fall within the limits represented by its base (between z and $z + dz$); and the area between any two ordinates of the curve $\left(\int_{b}^{a} ydz\right)$ divided by the whole area will still measure the probability that a deviation will be between a and b.

The curve just described is the *probability curve* for the lateral deviations of the projectiles of the particular gun considered, and while the probability curve for the vertical deviations, or that for either lateral or vertical deviations in the case of any other gun, would differ somewhat from this particular curve, all would present the following general features: (1) Since plus and minus deviations are equally likely to occur, the curve must be symmetrical to the right and left of the origin, which is the mean point of impact. (2) Since the deviations are made up of elemental deviations which, as they may have either direction, tend to cancel one another, small deviations are more frequent than large ones, so that the maximum ordinate occurs at the origin. (3) Since large deviations (which can only result when most of the elemental deviations have the same direction and their greatest magnitude) are rare, and deviations beyond a certain limit do not occur, the curve must rapidly approach the horizontal axis both to right and left, so that the ordinate (which can never be negative) practically vanishes at a certain distance from the origin.

If $y = \phi(z)$ is the equation of the probability curve, the general features just stated require, (1) that $\phi(z)$ shall be an even function, that is, a function of z^2, (2) that $\phi(0)$ shall be its maximum value, (3) that it shall be a decreasing function of z^2 and

shall practically vanish when z is large. Since it is impracticable to select the function ϕ so that $\phi(z)$ shall be constantly equal to zero when z exceeds a certain limit, the last condition requires that the curve shall have the axis of z for an asymptote; in other words, we must have $\phi(\pm\infty) = 0$.

The foregoing characteristics being thus established, and taking as its basis the axiom that the arithmetical mean of the observed values (made under similar circumstances and with equal care) of any quantity is its most probable value, the theory of accidental errors deduces as the equation to the probability curve,

$$y = \frac{1}{\pi\gamma}\epsilon^{-\frac{z^2}{\pi\gamma^2}}$$

In which γ is the mean error, or in our case the mean deviation, $\pi = 3.14159$, and $\epsilon = 2.71828$, and the factor $\frac{1}{\pi\gamma}$ has been introduced to make the whole area under the curve equal to unity $\left(\int_{-\infty}^{+\infty} \epsilon^{-\frac{z^2}{\pi\gamma^2}}\,dz = \pi\gamma\right)$, thus obviating the necessity of dividing a partial area by the whole area (in the manner described above) whenever a probability is to be computed.

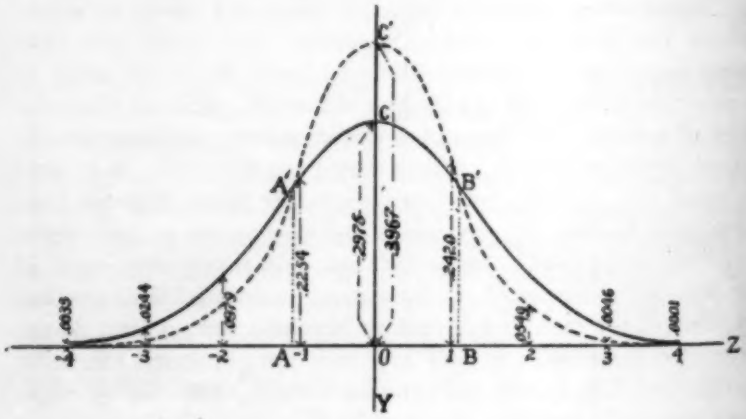

Fig. 2.

Figure 2 represents the probability curve for the Krupp 12 cm. siege gun, taking its mean error to be 1.07 meters, as given

by the 50 shots referred to above; also, in dotted lines, for comparison, the probability curve for a gun whose mean error is ¾ that of the 12 cm. gun. In both curves the ordinates are exaggerated ten times as compared with the abscissæ.

The maximum ordinate, being the value of y when $z = 0$, is inversely proportional to the mean deviation $\left(y\Big]_{z=0} = \frac{1}{\pi\gamma}\right)$: the probability that a deviation will be less than OB = OA is the numerical value of the area AA′CB′B in the one case and AA′C′B′B in the other case; the probability that a deviation will exceed OB = OA is the area under that part of the curve which is to the left of AA′ and to the right of BB′: the whole area under each curve has the numerical value one. It will be seen how very small is the probability of any deviation exceeding three times the mean deviation.

The probability (P) that the deviation of any single shot will be numerically less than a given quantity (a) being measured by the area between the ordinates of the probability curve at $z = +a$ and $z = -a$, and that curve being symmetrical to the axis of Y, we have

$$P = \frac{2}{\pi\gamma}\int_0^a \epsilon^{-\frac{z^2}{\pi\gamma^2}}\, dz.$$

The following table gives the values of P, calculated from this equation, but arranged for convenient use with the ratio $\frac{a}{\gamma}$ as the argument. Knowing the mean lateral deviation (γ_x) of a gun, to find the probability of a shot striking within the distance a to right or left of the mean point of impact, it is only necessary to take from the table the value of P which corresponds to the argument $\frac{a}{\gamma_x}$. And so, too, the probability of a shot striking within the distance a above or below the mean point of impact is the value of P which corresponds to the argument $\frac{a}{\gamma_y}$, γ_y being the mean vertical deviation.

Probability of a deviation less than a in terms of the ratio $\frac{a}{\gamma}$.

$\frac{a}{\gamma}$	P	$\frac{a}{\gamma}$	P	$\frac{a}{\gamma}$	P	$\frac{a}{\gamma}$	P
0.1	.064	1.1	.620	2.1	.906	3.1	.987
0.2	.127	1.2	.662	2.2	.921	3.2	.990
0.3	.189	1.3	.700	2.3	.934	3.3	.992
0.4	.250	1.4	.735	2.4	.945	3.4	.994
0.5	.310	1.5	.768	2.5	.954	3.5	.995
0.6	.368	1.6	.798	2.6	.962	3.6	.996
0.7	.424	1.7	.825	2.7	.969	3.7	.997
0.8	.477	1.8	.849	3.0	.983	4.0	.999
0.9	.527	1.9	.870	2.9	.979	3.9	.998
1.0	.575	2.0	.889	2.8	.974	3.8	.998

As an illustration of the use of the table, we will find the probability of the deviation not exceeding 1 meter and 2 meters in the case of a gun whose mean lateral deviation is 1.07 meters, and will compare our results with those given by the actual firing of 50 shots from the Krupp 12 cm. gun. Taking $a = 1$ meter, we have $\frac{a}{\gamma} = .935$, and $P = .544$: the probability that the lateral deviation of a single shot will not exceed one meter is .544; therefore of 50 shots 27 should fall within one meter on either side of the mean point of impact; actually 27 did so fall. Taking $a = 2$ meters, we have $\frac{a}{\gamma} = 1.87$, and $P = .864$; the probability that the lateral deviation of a single shot will not exceed 2 meters is .864; therefore of 50 shots 43 should fall within 2 meters on either side of the mean point of impact; actually 43 did so fall.

If P is the probability that the deviation of any single shot will not be greater than a, then evidently 100 P will be the probable number of shot out of 100 which will fall within the limits $\pm a$; in other words, 100 P is the percentage of hits to be expected upon a band 2 a wide with its center at the mean point of impact. Thus we see, from the table, that the half width of the band which will probably receive 25% of the shot is $0.4\,\gamma$, while the half width of the band which will probably receive 50% of the shot is $0.846\,\gamma$. These facts are usually expressed by saying that the widths of the 25% rectangle and of the 50% rectangle are respectively 0.80 and 1.69 times the mean error.

The half width of the 50% rectangle is known as the

probable error, or in our case the *probable deviation*, since it is the error, or deviation, which is just as likely to be exceeded as it is not to be exceeded.

If we wish to find the probability of hitting an area whose width is 2 b and whose height is 2 h, since the lateral and vertical deviations are independent of one another, the probability is the product of the two values of P taken from the table with the arguments $\frac{b}{\gamma_z}$ and $\frac{h}{\gamma_y}$, where γ_z and γ_y are the mean lateral and the mean vertical deviations respectively. Thus, supposing γ_z to be 4 feet and γ_y to be 5 feet, the probability of hitting with a single shot a 20-foot square with center at the mean point of impact is $P_1P_2 = .954 \times .889 = .848$, $P_1 = .954$ being the value of P for $\frac{b}{\gamma_z} = \frac{10}{4} = 2.5$ and $P_2 = .889$ being the value of P for $\frac{h}{\gamma_y} = \frac{10}{5} = 2$.

The Mean Errors of Guns.

We have thus far only considered the chances of hitting when the mean point of impact is at the center of the target, but this is very far from being an attainable condition in the service use of guns, especially of naval guns. Even with a stationary target, at a known range, it is difficult to so regulate the fire as to bring the mean point of impact, after a few trial rounds, close to the center of the target, and when the target is moving, with a speed and in a direction both only estimated, when the range is but approximately known, and when the gun itself is in motion, the most expert regulation of the fire by observation of the points of fall can do no more than to keep the mean point of impact in the neighborhood of the object attacked.

Let O be the mean point of impact, and ABCD the target (Figure 3) at any moment, and let the coordinates of the center of ABCD, with reference to vertical and horizontal axes through O, be y_0 and z_0; also let the mean vertical and lateral deviations be γ_y and γ_z respectively and let the dimensions of the target be 2 h and 2 b. Then the probability of a shot falling between the vertical lines Cc and C'c' is the tabular value of P for the argument $\frac{z_0+b}{\gamma_z}$ (which we will call $P_z(z_0+b)$), and the probability of a shot falling between Dd and D'd' is the tabular value of P for the argument $\frac{z_0-b}{\gamma_z}$ ($P_z(z_0-b)$). Therefore the probability

of a shot falling between Cc and Dd is one-half the difference of the two preceding probabilities, or $\frac{1}{2}[P_z(z_0+b) - P_z(z_0-b)]$. Similarly the probability of a shot falling between the horizontal lines C'C and B'B is $\frac{1}{2}[P_y(y_0+h) - P_y(y_0-h)]$. Hence the probability of hitting ABCD is the product of these two quantities, or $\frac{1}{4}[P_z(z_0+b) - P_z(z_0-b)]\ [P_y(y_0+h) - P_y(y_0-h)]$.

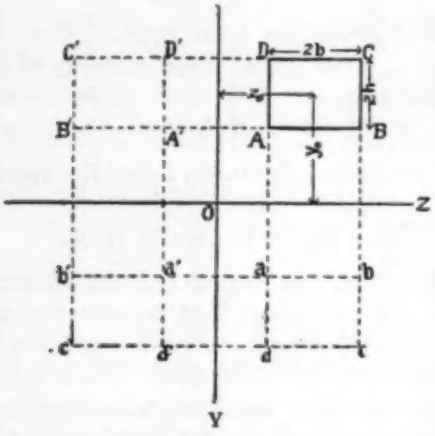

Fig. 3.

To illustrate, suppose we wish to find the probable percentage of hits on a gun-port 4 feet square, if the mean point of impact is 3 feet to one side and 4 feet below the center of the port, the value of γ_z being 3.72 feet and that of γ_y being 4.14 feet. Here we have $P_z(z_0+b) = P_z(5) = .717$; $P_z(z_0-b) = P_z(1) = .170$; $P_y(y_0+h) = P_y(6) = .751$; $P_y(y_0-h) = P_y(2) = .298$. Therefore the probability of hitting the post is $\frac{1}{4}(.717 - .170)(.751 - .298) = \frac{1}{4} \times .547 \times .453 = .062$, and the percentage of hits would be 6.2. Under the same circumstances, but with the mean point of impact at the center of the post, the percentage of hits would be 9.9.

Evidently the less the mean errors of a gun the more important it is to accurately regulate its fire; if the distance of the mean point of impact from the target is more than three times the mean error of the gun there will be practically no hits at all.

To illustrate the preceding statement, we will take the case of a 6-inch gun firing at a heavy gun position, 25 feet high by 32 feet in diameter and 3000 yards distant. Supposing the mean vertical and lateral deviations each to be 10 feet; if the mean point of impact coincides with the center of the target, the probable percentage of hits will be found to be 54.3; but if the sights are set for a range 10% more or less than the true distance the mean point of impact will be raised, or lowered, about 43 feet, and the percentage of hits will be reduced to 0.7. If, on the other hand, the mean errors of the gun were each 20 feet, or double what was first assumed, while the percentage of hits with perfect regulation of the fire would be reduced to 18.2, that with sight setting for a range 10% in error would be increased to 4.7. Thus we see that a gun may be severely handicapped by its own accuracy if the range is not known within 10%.

If we know the percentage of hits at a given range on a target of given size, we can make a rough estimate of the mean errors of the gun by assuming that the mean point of impact was at the center of the target, and the greater the number of rounds fired the more nearly correct will the determination probably be. For example, the eighty 6-inch guns of certain British ships, firing separately, made 295 hits out of 650 rounds fired, 45.4% of hits, on a target 15 feet high by 20 feet wide at a mean range of 1500 yards. Here we have given that the product of $P\left(\frac{10}{\gamma}\right)$ by $P\left(\frac{7.5}{\gamma}\right)$ is .454, and by a process of trial and error we readily find from the table that γ is slightly less than 7 feet, since $P\left(\frac{10}{7}\right)$ by $P\left(\frac{7.5}{7}\right) = .745 \times .581 = .432$.

The number of rounds necessary to make at least one hit is determined as follows: Let p be the probability of hitting with a single shot; then $1 - p$ is the probability of a single shot missing; and $(1-p)^n$ is the probability that all of n shots will miss; hence the probability of hitting at least once with n shots is $P = 1 - (1-p)^n$. Solving this equation for n, we have $\log(1-P) = n \log(1-p)$; $n = \frac{\log(1-P)}{\log(1-p)}$; and by giving P a value near unity we can find the value of n, which will make one hit as nearly certain as we wish. As an illustration, taking a case in which 94 shots were fired from a mortar at a Gruson turret and in which the calculated probability of a hit with a single

shot was .011, let us see how many rounds should have been fired to make the probability of at least one hit .95. In that case $p = .011$, and so we have $n = \frac{\log(1-.95)}{\log(1-.011)} = \frac{8.69897\ (-10)}{9.99520\ (-10)} = \frac{-1.30103}{-0.00480} = 271$; so that 271 shots must be fired to make the odds 19 to 1 that there will be at least one hit. The probability of at least one hit with the 94 shots actually fired was $P = 1-(1-p)^n = 1-.354 = .646$.

The Mean Errors of Guns on Steady Platforms. The deviations of the projectiles fired from a gun on a steady platform, the mean of which we will call the mean error of the gun, lateral or vertical as the case may be, are principally caused by (1) errors of the gun pointer in sighting the gun, (2) an initial angular deviation of the projectile, (3) variations of the initial velocity, and (4) differences between the projectiles.

With open sights the most expert gun pointers make a considerable angular error, which varies from round to round, when they point a gun by directing its line of sight at a mark. With telescope sights this error is greatly lessened, but still exists. There is also always an error in setting the sights (we suppose the range to be unchanged, but the sights to be reset for each round). The *mean angular error of sighting* can only be estimated, but it is unlikely that it is less than one minute, even with the telescope sight, under ordinary conditions of rapid firing; the resulting mean deviation at 2000 yards range would then be about 21 inches, and may be taken to occur indifferently in all directions, though it is somewhat greater vertically than laterally. Such a deviation is equivalent to a mean vertical deviation of $\frac{21}{\sqrt{2}} = 15$ inches together with a mean lateral deviation of the same value.

The *initial angular deviation* results from the projectile not leaving the gun in the exact line of the latter's axis. This deviation, which occurs indifferently in all directions, was quite large with smooth-bore guns and with some of the early rifles, but with modern guns, using projectiles rotated by forced bands, its mean value is probably not more than half a minute of arc. The mean deviation of the projectiles at 2000 yards' range would be about 10.5 inches by reason of this cause, and this is equivalent

to a mean vertical deviation of $\frac{10.5}{\sqrt{2}} = 7.5$ inches together with a mean lateral deviation of the same value.

With all powders the muzzle velocity varies from round to round, no matter what care be taken to insure uniformity of the charges. With the gun-cotton smokeless powder now used in the U. S. Navy, if the charges have been made up with proper care, and the projectiles are all of the same weight, the average difference between the velocities given by successive rounds and the mean velocity of all the rounds fired on any one occasion will probably not exceed 10 f. s. That is, if a large number of rounds are fired, and the average velocity is, say 2400 f. s., then probably no one velocity will differ more than 30 f. s. from the average and somewhat more than half the velocities will be within 10 f. s. of the average. Such a variation will cause a mean vertical deviation of the projectiles at 2000 yards range of 11 or 12 inches, for guns whose average initial velocity is 2400 f. s., and of 7 or 8 inches for guns having 2800 f. s. muzzle velocity.

The projectiles of any gun differ among themselves in shape and smoothness, but when they all have the same form of head and the various kinds are not of greatly different lengths, the resulting deviations are not so important as those caused by the variations in their weights. If we take the mean variation in weight to be 1% of the standard weight, the resulting mean vertical deviation at 2000 yards' range will be about 9 inches.

Neglecting the other numerous, but lesser, causes of deviation, and assuming that those described are independent of one another, we find the mean vertical and the mean lateral deviation which results from their combined action by taking the square root of the sum of the squares of the corresponding partial mean deviations.* And thus we have $\gamma_y = (15^2 + 7.5^2 + 9.5^2 + 9^2)^{\frac{1}{2}} = 21\frac{1}{4}$ inches, and $\gamma_z = (15^2 + 7.5^2)^{\frac{1}{2}} = 16\frac{3}{4}$ inches.

Of course the only correct way of determining the mean errors of a given gun is by actually firing a large number of rounds at a target and measuring the deviations, but the foregoing estimate will serve to give an idea of the errors to be expected in the case of modern guns of medium and large calibers.

*It is demonstrated in the Calculus of Probabilities that the mean value of the total error resulting from any number of independent causes is the square root of the sum of the squares of the mean partial errors.

That the errors are very small under the favorable circumstances thus far considered is illustrated by Figure 4, which represents a target made at Meppen on June 1, 1882, with a 28-cm. gun, the distance of the target from the gun being 2026 meters (2215 yards). The dotted cross is the mean point of impact, whose coordinates, referred to horizontal and vertical axes at the center of the target, are $z = 32.4$ inches, and $y = -11.6$ inches. The mean lateral deviation is 9.5 inches, and the mean vertical deviation is 11.6 inches.

The fact that these actual deviations are considerably less than the estimated ones may be plausibly ascribed to the fact that in Proving Ground firings greater care is taken in pointing the gun than is usually practicable under service conditions.

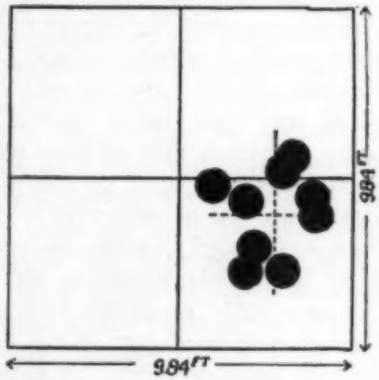

Fig. 4.

The Effect of Motion of the Gun Platform and Target.— The three angular motions of a ship's deck, caused by rolling, pitching, and yawing, greatly increase the mean errors of naval guns, but their effects depend so much upon the skill of the gun pointer, as well as upon the state of the sea and the characteristics of the particular ship and gun mounting, that only the roughest estimate of their values can be made.

Most naval guns are mounted in broadside and only train from bow to quarter, and even guns mounted on the middle line are likely to be used most on the broadside; thus the roll, which is the greatest and most rapid of a ship's angular motions, has its largest component in the plane of fire, and acts principally to

increase the vertical deviations. The principal effect of pitching, on the other hand, is to increase the lateral deviations by causing the plane of the sights to be more or less inclined, now to one and now to the other side of the plane of fire. Motion in azimuth, mostly due to unsteady steering, affects the lateral deviations only.

If the target is in motion, the gun pointer must, of course, estimate its speed and direction in order to direct his fire at the point where the target will be when the projectile strikes, and his corrections must always vary in their accuracy from round to round, thus increasing both the lateral and the vertical deviations. Moreover, the changing direction of the target will cause the angle between the direction of the wind and the plane of fire to vary, thus necessitating a variable allowance for wind effect and again increasing the deviations of the projectiles.

Taking everything into account, probably a fair estimate of the mean vertical deviation of modern naval guns of medium and large caliber at 2000 yards range, with skilled gun pointers, and under average conditions, would be 5 feet. The mean lateral deviation, which for guns on steady platforms is from two-thirds to three-fourths the mean vertical deviation, may be taken to be the same as the mean vertical error in the case of naval guns without any great error.

Both vertical and lateral deviations may be taken to be proportional to the range, at least up to 4000 or 5000 yards range, though the former really increases somewhat more rapidly than the range.

Although the targets of naval guns are vertical, their fire must generally be regulated by observation of the points of fall on a horizontal plane. The lateral deviations are practically the same whether measured on the vertical plane (perpendicular to the plane of fire) or on the horizontal plane, but the deviations in range differ very greatly from the vertical deviations, the ratio between them being the cotangent of the angle of fall.

The Mean Deviation in Range.—Since the mean deviation in range (γ_x) is related to the mean vertical deviation (γ^r) by the formula $\gamma_x = \gamma_y \cot \omega$, and since the angle of fall increases (and its cotangent correspondingly decreases) with increase of range at about the same rate as the mean vertical deviation, it will be seen that the mean deviation in range remains nearly the same for widely different ranges. Thus, for example, while the esti-

mated mean vertical deviation of the 12-inch gun of 2800 f. s. I. V. increases from 2.5 feet at 1000 yards range to 10.5 feet at 4000 yards range, the corresponding mean deviation in range only changes from 119 yards to 104 yards; and while in the case of smaller guns the mean deviation in range decreases more rapidly, still the change is always very much less proportionately than the change in range itself.

The principal use of knowledge of the mean deviation in range is in the regulation of gun-fire by observation of the points of fall.
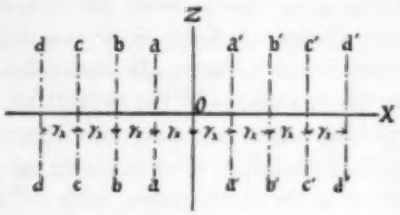
Fig. 5.

Suppose the axis of Z in Figure 5 represents the water line of the target, the axis of X being the trace of the plane of fire; and let the distances from Z to the dotted lines aa, a'a', bb, b'b', etc., represent once, twice, etc., the mean deviation in range (γ_x) of the gun. Then if the mean point of impact is on Z, half of all the shots will fall short; if it is on aa, the percentage of shots which fall short will be increased by the number which fall between Z and aa, or, from the table of probabilities, it will be $50 + \frac{57.5}{2} = 79\%$; if the mean range is still further short, so that the mean point of impact falls on bb, the perctentage of shorts will be $50 + \frac{88.9}{2} = 94\%$; and, finally, if the mean point of impact is three or more times the mean deviation short, then practically all the shot will fall short. The same reasoning shows that if no shot strike short of Z, the mean point of impact is three or more times the mean deviation in range beyond Z; if about 6% strike short, the mean point of impact is about $2\gamma_x$ beyond Z; and if about 21% are short, it is about γ_x beyond Z.

Thus by observation of the percentage of shot which strike short it is possible to determine with some accuracy how much the sight bars should be raised or lowered to bring the mean point of impact on the target.

How closely the calculated percentages of hits agree with the results of experiment when the number of shots fired is considerable, is illustrated by the following table taken from Hélie's well-known Traité de Balistique. It represents about 500 shots fired at Gavre from the 16.5-cm. rifle at various angles of elevation.

Probability that the lateral deviation will not exceed

	$\frac{\gamma z}{4}$	$\frac{\gamma z}{2}$	γz	$2\gamma z$	$3\gamma z$
By table	0.158	0.310	0.575	0.889	0·983
By experience	0.176	0.300	0.502	0.885	0.988

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THE SUMNER LINE OF GEOGRAPHICAL POSITION AND THE COMPASS ERROR SERVICEABLY DEDUCED BY INSPECTION.

By G. W. LITTLEHALES.

To make an intelligent introduction of the solution which is to be disclosed, it will be of advantage to set forth briefly some principles that are well recognized among navigators. Defining

FIG. 1.

the *sub-celestial* place of any body in the firmament as the point of intersection with the surface of the earth of a straight line drawn from the celestial body to the center of the earth, it will be evident that the geographical position of the sub-celestial place

is in a latitude equal to the declination of the celestial body and in a longitude equal to the hour-angle of the celestial body from the prime meridian, and that the celestial body is in the zenith of the sub-celestial place.

In Fig. 1, take A to be the sub-celestial place of a celestial body whose declination is equal to the latitude of A and whose hour-angle at Greenwich is equal to the longitude of A west of the meridian of Greenwich, and B to be any point on the surface of the earth whose great-circle distance from A is z, then to an observer at B the zenith-distance of the celestial body in the zenith of A will also be z, and as B may lie in any direction from A, it follows that the zenith-distance of the celestial body will be the same to an observer situated at any point on a small circle of the earth whose pole is the sub-celestial place and whose circumference is everywhere distant from the sub-celestial place by a great-circle arc equal to the zenith-distance. Therefore, if a navigator, having measured the altitude of a celestial body, should obtain its zenith-distance, he is certain that at the instant of observation his geographical position is somewhere upon the circumference of such a small circle. In practical navigation, the ship's position as given by dead-reckoning always limits the position of the circumference, upon which an observer can possibly be, to such a small arc that, if laid down upon any chart-projection, it will not differ sensibly from a straight line. Such a straight line is called a Sumner Line, and, for the same reason that the tangent to the circumference of a circle at any point is at right angles to the radius drawn to that point, it possesses the property of being at right angles to the true bearing of the celestial body upon whose zenith-distance it depends.

Reverting to Fig. 1, let E represent the estimated geographical position of the observer at the time when the altitude is measured which gives the zenith-distance z, equal to A B. If the observer should compute or by any other means deduce the great-circle distance EA and the bearing of A from E (which represent respectively the zenith-distance and azimuth of the celestial body as they would appear to an observer at E), the portion of the small circle BB′, B″B‴ which represents the actual Sumner Line of Position, could at once be laid down on the navigating chart, for it would be at right angles to the bearing of the observed celestial body and removed from the estimated geo-

graphical position by a perpendicular distance equal to the difference in minutes of arc between the observed and deduced zenith-distance, and toward the direction of the observed celestial body or away from it, according as the zenith-distance obtained by observational measurement is less or greater than the zenith-distance deduced by dependence on the estimated geographical position.

This process of finding the Sumner Line has come into current use among many navigators under the name of the New Navigation, and the present practice is to compute the zenith-distance and the azimuth of the observed celestial body in the following manner:

A latitude and longitude having been assumed within the extreme limits of both as given by the dead-reckoning, from the G. M. T., as known from the chronometer, the hour-angle of the observed celestial body, to an observer situated in this assumed geographical position, is now calculated from the formulæ:

L. M. T. = G. M. T. ± the assumed longitude expressed in time, the upper sign being used when the longitude is east and the lower sign when it is west of Greenwich; and when the sun is the observed body:

Sun's hour-angle = L. M. T. ± the equation of time;

and for any other celestial body:

Star's hour-angle = L. M. T. + R. A. Mean Sun — R. A. Star.

With this hour-angle and the two including sides of the astronomical triangle, viz., the assumed co-latitude of the observer and the known polar distance or co-declination of the observed celestial body, the opposite side of the triangle, which is the zenith-distance or co-altitude of the celestial body, is computed from the formulæ:

$$\sin \frac{x}{2} = \sin \frac{t}{2} \cos L \cos d \sec (L—d) \qquad (1)$$

$$\cos z = \cos (L—d) \cos x$$

in which x = an auxiliary angle,
t = the hour-angle,
L = the latitude,
d = the declination,
and z = the zenith-distance;

and the true bearing, or angle opposite the side of the astronomical triangle representing the polar distance, is computed from the formula:

$$\sin Az. = \sin t \cos d \operatorname{cosec} z. \qquad (2)$$

There are superior qualities attached to this method of finding the Sumner Line because it may be used in any circumstances so long as the altitude of the observed celestial body does not greatly exceed 80°, and the results obtained have been demonstrated to possess an enhanced probability of accuracy. The present purpose, however, is not to discuss these advantages

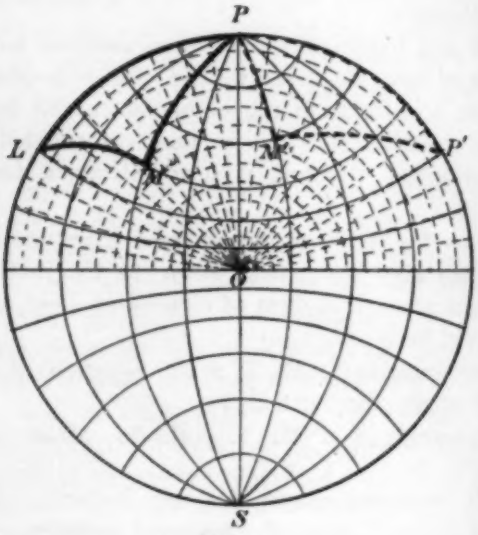


FIG. 2.

which have been expounded by writers upon the subject of The New Navigation, but to disclose a short, simple process of finding the zenith-distance and azimuth without the aid of the extended computations indicated by the formulæ just referred to, and so to provide for the practice of a method of finding the Line of Position and the Compass Error by inspection.

Fig. 2 represents a stereographic projection of the celestial sphere on the plane of the meridian.

If the latitude of the observer be laid off along the bounding meridian at L, and the declination of the observed celestial body be laid off at M along a meridian making an angle with the

bounding meridian equal to the hour-angle of the observed celestial body, an astronomical triangle will be formed in which the known parts are the two sides PL and PM, representing respectively the co-latitude and co-declination, and their included angle LPM, which is the hour-angle of the observed celestial body. Two of the unknown parts of this triangle are the azimuth, PLM, and the co-altitude, LM, of the observed celestial body. If the triangle, PLM, were revolved about the central point of the projection, with the side PL, kept in coincidence with the bounding meridian, until the point L is brought to the position of the point P, the latter would then occupy the position P′, and the point M would fall at M′, so that the unknown side of the triangle, representing the co-altitude, would lie along some meridian, and could be measured from the graduation on the projection, and the unknown angle, representing the azimuth, would become an included angle between two meridians, which could likewise be measured from the graduations of the projection. And thus the altitude and azimuth of any observed celestial body could be simultaneously determined from the diagram with any degree of precision that the scale of the projection might permit. To obviate the necessity for actual revolution of the triangle, as described above, a series of equally-spaced concentric circumferences and a series of equally-spaced radial lines have been drawn over the projection in lines of dashes. For the purposes of identification, the overlaid system of concentric circumferences is numbered serially from the center of the projection outwards to the bounding meridian, and the radials are also marked by numbers indicating their angular distance in minutes of arc counted in a clockwise direction from some fixed origin, like the line OS; so that, having plotted the declination and hour-angle of the observed celestial body at M, it is only necessary to note the number of the circumference and the number of the radial which pass through this position, and then, adding the co-latitude expressed in minutes to the number of the radial, find the intersection, M′, of the noted circumference with the radial whose number is the sum just found, and read off from the graduated arcs of the projection the altitude and azimuth of this point of intersection.

In order that the required results might be found to the nearest minute of arc, the stereographic projection was constructed

with a diameter of twelve feet; but this, in one continuous sheet, was obviously of unmanageable size for ordinary use, and had to be changed to convenient form by being cut up into the overlapping sections which form the pages of this book. In this form the projection can be used with the same facility as if preserved in one continuous sheet, for it has been pointed out that, in effecting the required solution, only those parts of the projection are involved which lie in the immediate vicinity of the points whose co-ordinates are to be plotted or read off.

To complete the illustration of the method it will be sufficient to treat one example, inasmuch as the process of solution is identical in every case.

Example.

At sea, April 2, 1902, about 6h. 35m. p. m., in latitude 39° 16′ N. and longitude 60° 00′ W. by estimation observed α Aurigae, bearing N. 60° W. per compass, to be in altitude 66° 29′ 25″ with the observer's eye at a height of 31 feet above the sea-level, the index-correction of the sextant being 1′ 30″. Chronometer time of observation 6h. 28 m. 34s.: chronometer slow on G. M. T. 4h. 2m. 18.2s. Required the Sumner Line of geographical position and the Total Error of the Compass.

Preparation of the Data.

C =		6h.	28m.	34s.	Obs'd Alt. =	66° 29′ 25′
C.C. =	+	4	02	18.2	I.C. =	1 30
G.M.T. =		10	30	52.2		66 27 55
Estimated Long. =		4	00	00 W.	Dip. =	5 29
" L.M.T. =		6	30	52.2		66 22 26
R.A.M. Sun =		0	41	30.0	Ref. =	0 26
		7	12	22.2	True Alt. =	66° 22′
R.A. α Aurigae =		5	09	28.2		
Hour Angle =		2	02	54.0 =		30° 43′ 30″

Greenwich date of obs'n, Apr. 2d, 10h. 30m. 52.2s.

= Apr. 2d .44

R.A.M. Sun Apr. 2d =	oh.	39m.	34.95s.
Corr. =	1	55.08	
do. Apr. 2d .44 =	0	41	30.03
R.A. α Aurigae, 31d .2 =	5	09	28.23
Corr. =			0.06
do. Apr. 2d .44 =	5	09	28.2

Dec. α Aurigae, Mar. 31d .2 = + 45° 53′ 56.8″

" " " Apr. 2d .44 = + 45 53 56.6

Note.

Plotting the declination and hour-angle roughly with reference to the parallels and meridians (counted from the left-hand bounding meridian) of the Index to Plates, we find that the position of the observed body falls on Plate 51 approximately at the intersection of circumference 17.4 with radial 8400, and adding to 8400 the co-latitude expressed in minutes, which is 3044, we find the approximate place of the revolved position to be at the intersection of circumference 17.4 with radial 8400 + 3044 = 11444, which intersection falls within the limits of Plate 136. Turning now to Plate 51 and plotting the hour-angle and the declination to the nearest minute we find the position of the observed body to fall at the intersection of circumference 495.6 with radial 8410.1. Adding the co-latitude expressed in minutes to the number of this radial we obtain 8410.1 + 3044 = 11454.1 as the number of the radial at whose intersection with circumference 495.6, on Plate 136, the solution is to be found by reading off the altitude with reference to the parallels and the azimuth with reference to the meridians counting from the right-hand bounding meridian.

Solution.

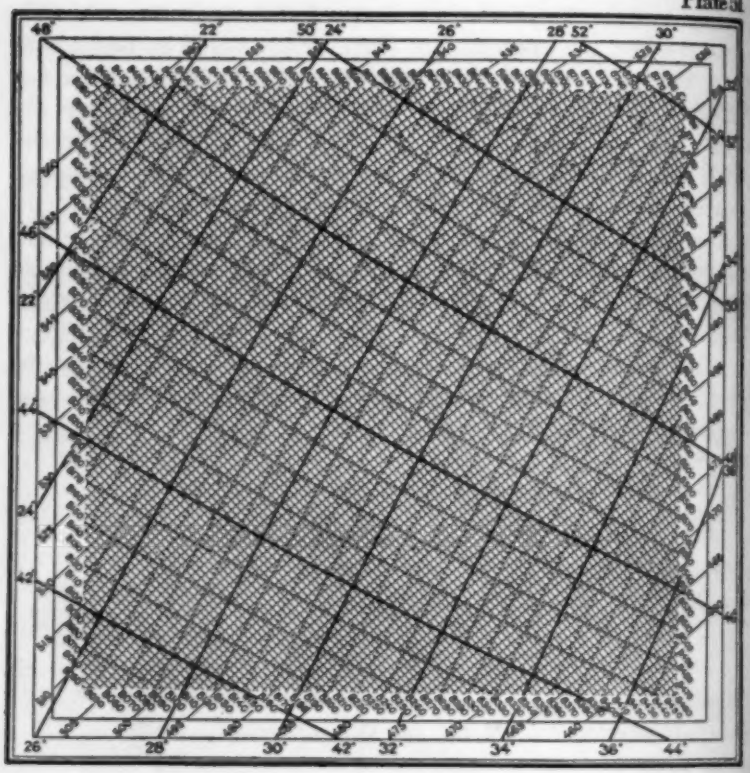
Hour-Angle =	30° 43½′	circ. 495.6	
Declination =	+45 54	Rad. 8410.1	
Lat. N. 39° 16′ =	Co. Lat. 50° 44′ =	3044	
		Rad. 11454.1	66° 36′ Altitude.
		circ. 495.6	N. 63 32 W. Azimuth.
True Bearing	N. 63° 32′ W.	True Alt. by	
Compass Bearing . . .	N. 60 00 W.	observation =	66° 22′
Total Error of Compass for heading of ship =	3° 32′ W.	Alt. due to estimated position	66 36
when observation was made.		Δh	14′

Courses and Distances in Great-Circle Sailing.

In Fig. 2, if L be taken to represent the latitude of the point of departure laid off along the bounding meridian and M the latitude of the point of destination laid off along a meridian

making an angle with the bounding meridian equal to the difference of longitude between the point of departure and the point of destination, then the length of the side LM of the spherical triangle PLM will be the great-circle distance between the point of departure and the point of destination and the angle PLM

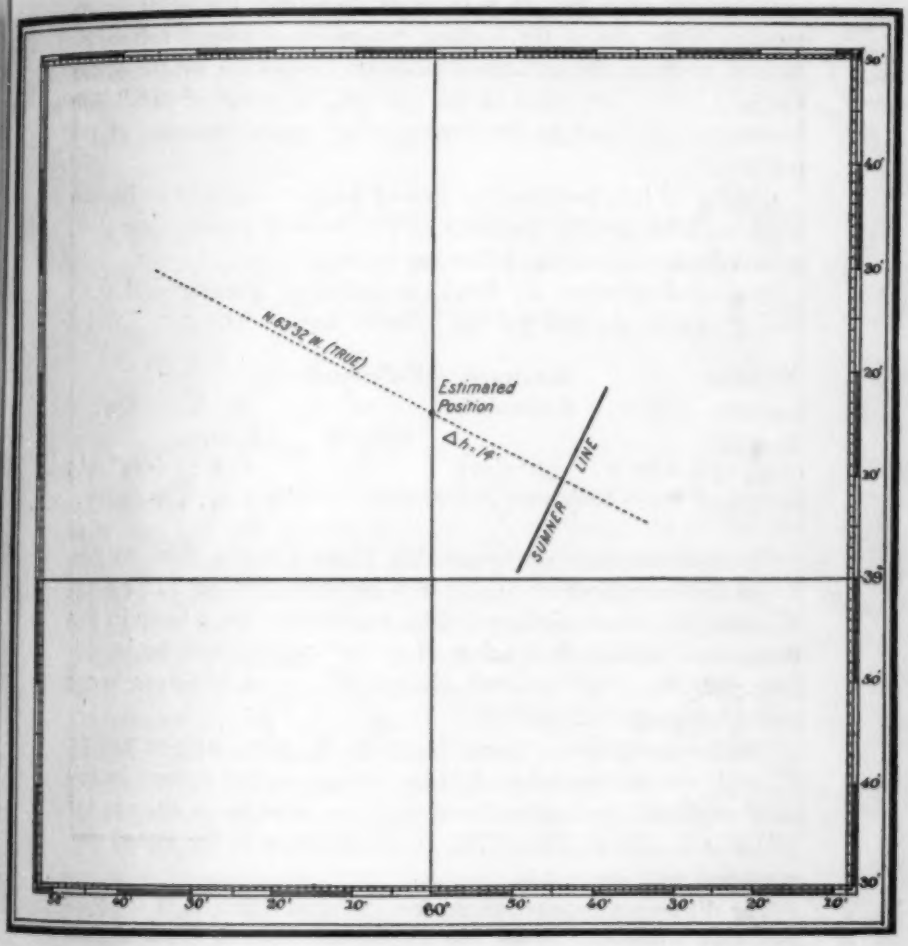
Plate 51



will be the initial course for a vessel proceeding along the great-circle track between L and M. It will therefore be apparent that the course and distance in great-circle sailing may be found with very great facility by the method of solution which has just been described.

The altitude represented as having been measured in the foregoing problem is subject, like all other observed altitudes that navigators are accustomed to take for the purpose of fixing a

position, to the uncertainties introduced into instrumental measurement by the extraordinary deflection of the rays of light coming from the horizon, which frequently occurs in every part of the world to such an extent as to produce a displacement of



the horizon of large magnitude extending to five, ten, and even fifteen minutes of arc. And, perhaps among the greatest advantages that may be claimed for the foregoing method of solution is the facility with which it lends itself to a deduction of Wirtz's*

*Ausdem Archiv der Deutschen Seewarte, xxv Jargang-1902. "Ueber eine neue kimmfreie astronomische Standlinie," von Dr. phil. Carl W.

locus of geographical position by constant difference of altitude, of two observed celestial bodies with their difference of altitude which is found by comparing the measured differences of altitude as deduced by the foregoing method of finding altitude by inspection. Such a line of position is free from the usual uncertainties in the dip of the horizon caused by abnormal refraction, as well as from the additional uncertainties of the height of the eye, the index correction of the sextant, the want of parallelism in the mirrors, and to the errors of defective centering of the sextant.

9 point of this horizon-free line of position, as well as its azimuth may be speedily deduced by the method already described, as will be seen from the following example:

At sea, September 26, 1899, in estimated geographical position 3° 40′ south, and 32° 34′ west of Greenwich:

Chronometer	Star	Measured altitude	Difference of altitude	R. A.	Dec.
h. m. s.				h. m. s.	
18 45 45	α Arietis	38° 5′.0		2 1 33	+ 22° 59′.5
19 7 12	α Canis Maj.	56 7 .3	Δh = + 17° 2′.8	7 34 4	+ 5 29.

Chronometer slow on Greenwich Mean Time 2 Min. 39 Sec.

The hour-angle of α Arietis is +2h. 59m. 17s. or 44° 49′ 15″ W., and we are enabled to find by inspection that a body in this hour-angle with a declination of + 22° 59′ .5 must be in altitude 38° 48′ .5 and azimuth N. 57° W., to an observer in the stated geographical position.

The hour-angle of α Canis Major is 2h. 11m. 24s. or 32° 51′ E., and we are enabled to find by inspection that a body in this hour-angle with a declination of +5° 29′ must be in altitude 55° 56′ .2 and azimuth N. 74° E., to an observer in the stated geographical position.

The difference between these two deduced altitudes is 17° 7′ .7 and this subtracted from the measured difference of altitude set down in the statement of the problem gives the means, when taken in connection with the two deduced azimuths, of reducing the estimated place of observation to a point on the required line of position, by means of the following formula:

$$d\lambda = \frac{d\Delta h}{2} \sec \varphi \sec \frac{A_2 + A_1}{2} \operatorname{cosec} \frac{A_2 - A_1}{2}$$

in which $d\lambda$ = the difference of longitude between the assumed geographical position and the required point of the line of position.

$d\Delta h$ = the difference of the two differences of altitude as found by measurement and by inspection.

φ = the latitude of the assumed geographical position.

and A_1 and A_2 = the respective azimuths of the observed bodies.

$$\frac{d\Delta h}{2} = -2'.45 \text{ log } \ldots\ldots\ldots\ldots\ldots\ldots 0.389n$$

$$\varphi = 3^\circ\ 40' \text{ lg sec. } \ldots\ldots\ldots\ldots\ldots\ldots 0.001$$

$$\frac{A_2 + A_1}{2} = 188^\circ.5 \text{ lg sec. } \ldots\ldots\ldots\ldots\ldots\ldots 0.005n$$

$$\frac{A_2 - A_1}{2} = 114^\circ.5 \text{ lg cosec } \ldots\ldots\ldots\ldots\ldots\ldots 0.051n$$

$$\log (d\lambda) \ldots\ldots\ldots\ldots\ldots\ldots 0.436n$$

Having performed this computation, we find the value of $d\lambda$ to be $-2'.7$, which applied to $-32^\circ\ 34'$, the longitude of the assumed geographical position, becomes $32^\circ\ 36'.7$, which is the longitude of a point of the horizon-free line of position. The latitude of this point is the same as the latitude of the assumed or estimated geographical position. The co-ordinates of the required point of the line of position are, therefore, $\varphi = -3^\circ\ 40'$, $\gamma = -32^\circ\ 23.7'$. The azimuth of this line of position will be the mean of the azimuths of the two observed stars, which in this case is $188^\circ.5$ counting from north through east, south and west.

Obviously, if the two differences of altitude be measured, i. e., if three different stars have been observed in quick succession, two lines of position will be obtained, and their intersection is the true geographical position of the observer.

The formula that has been employed for reducing the estimated geographical position of the observer to the line of position or locus of constant difference of altitude, by computing the difference of longitude between the two points, is most appropriate in all cases in which the mean azimuth $\frac{A_2+A_1}{2}$ lies between 315° and 45° and between 135° and 225°.

When the mean azimuth lies outside these limits, or in other words when it lies between 45° and 135° and between 225° and 315°, it is better to reduce the estimated geographical position to a point on the required line of position by computing the difference of latitude between the two points in accordance with the following formula:

$$d\varphi = -\frac{d\Delta h}{2}\operatorname{cosec}.\frac{A_2+A_1}{2}\operatorname{cosec}.\frac{A_2-A_1}{2}$$

To Find the Name of an Observed Star.

Frequently a star that is favorably placed for observation can not be identified because clouds obscure the surrounding parts of the sky. If, when the altitude of such a star is measured, its compass bearing be observed and the approximate true azimuth be obtained by correcting the bearing for the variation and deviation of the compass, the identity of the star may at once be ascertained by reversing the order of proceedings that has been described for finding the altitude and azimuth from the declination and hour-angle. That is, having plotted the corrected altitude of the star on the meridian of the projection which makes an angle with the right-hand bounding meridian equal to the star's azimuth counted from the north pole, note the number of the radial and the number of the circumference that pass through the point so plotted, and, having subtracted the co-latitude of the place of observation expressed in minutes from the number of the noted radial, find the intersection of the noted circumference with the radial whose number is the remainder thus found by subtraction, and read from the graduations of the projection the declination of this point and its hour-angle from the left-hand bounding meridian. The hour-angle of the observed star thus found must be converted into right ascension by the following rule:

From the local mean time of observation and the star's hour-angle, to find the star's right ascension. To the right ascension of the mean sun (or sidereal time, American Nautical Almanac, page II, last column, also British Nautical Almanac, page II, last column), corrected for the Greenwich mean time of observation. The result will be the local sidereal time of observation. If the star is east of the meridian, add its hour-angle to the local sidereal time of observation; if west of the meridian, subtract its hour-angle therefrom. The result will be the right ascension of the star.

Then scan the star tables of the Nautical Almanac and find the name of the star whose tabulated right ascension and declina-

tion come nearest to the values of the right ascension and declination that have been deduced. The stars that are of a sufficient magnitude to be observed by navigators are so widely separated that there will be no difficulty in making the selection from the tables, even when we proceed no further than the use of the Index to Plates in effecting the required solution, as has been done in the following example:

At sea, February 26, 1901, local mean time (L. M. T.) 6h.-30m. p. m. Weather overcast and cloudy. Observed the altitude of an unknown star through a break in the clouds to be 29°-30′ (true), bearing N. 74° W. (true). What is the name of the star? Ship's position by dead-reckoning Lat. 35° N. Long. 60° W.

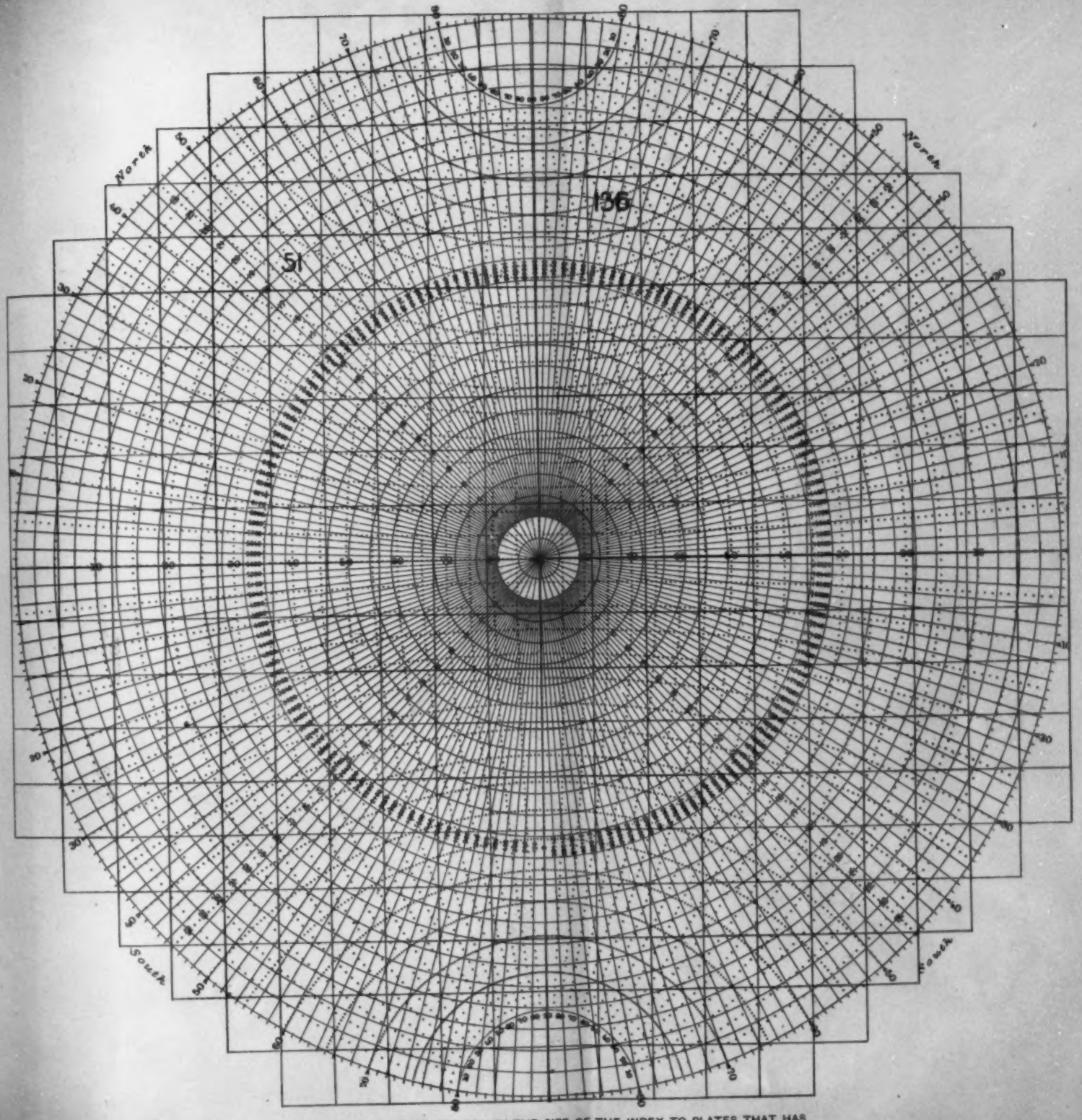
SOLUTION.

On the Index to Plates, plot the altitude, 29°-30′ on the meridian making an angle equal to the true bearing or azimuth (74°), with the right-hand bounding meridian, and note the number of the circumference and the number of the radial which pass through this point. They are circumference 7½ and radial 12360. Subtract the co-latitude ($90° - 35° = 55°$) expressed in minutes, which is $55° \times 60' = 3300$, from the number of the radial, and find the intersection of the radial whose number is the remainder ($12360 - 3300 =$) 9060 with the above-noted circumference 7½. Read for the graduations of the projection the declination of this point and its hour-angle reckoned from the left-hand branch of the bounding meridian. They are declination 28°-40′ North and hour-angle $72\frac{1}{2}° = 4$h.-50m.-. From the hour-angle thus deduced by inspection, we proceed to find the unknown star's right-ascension as follows:

L.M.T.	6h	30m	00s.
R.A.M.S.	22	22	33
Cor. G.M.T.		1	43
Local Sidereal Time.	4	54	
Star's hour-angle.	4	50	
Star's R.A.	oh	4m.	

The right ascension and declination of the unknown star, as we have approximately found them by inspection, are R. A. = oh.-4m. and Dec. = 28°-40′ N. The star is therefore Andromedæ, whose tabulated R. A. = oh.-03m.-16s. and Dec. = 82°-32′ N.

INDEX TO PLATES.



THIS DIAGRAM IS REDUCED BELOW THE SIZE OF THE INDEX TO PLATES THAT HAS BEEN DESIGNED TO ACCOMPANY THE COMPLETE WORK.

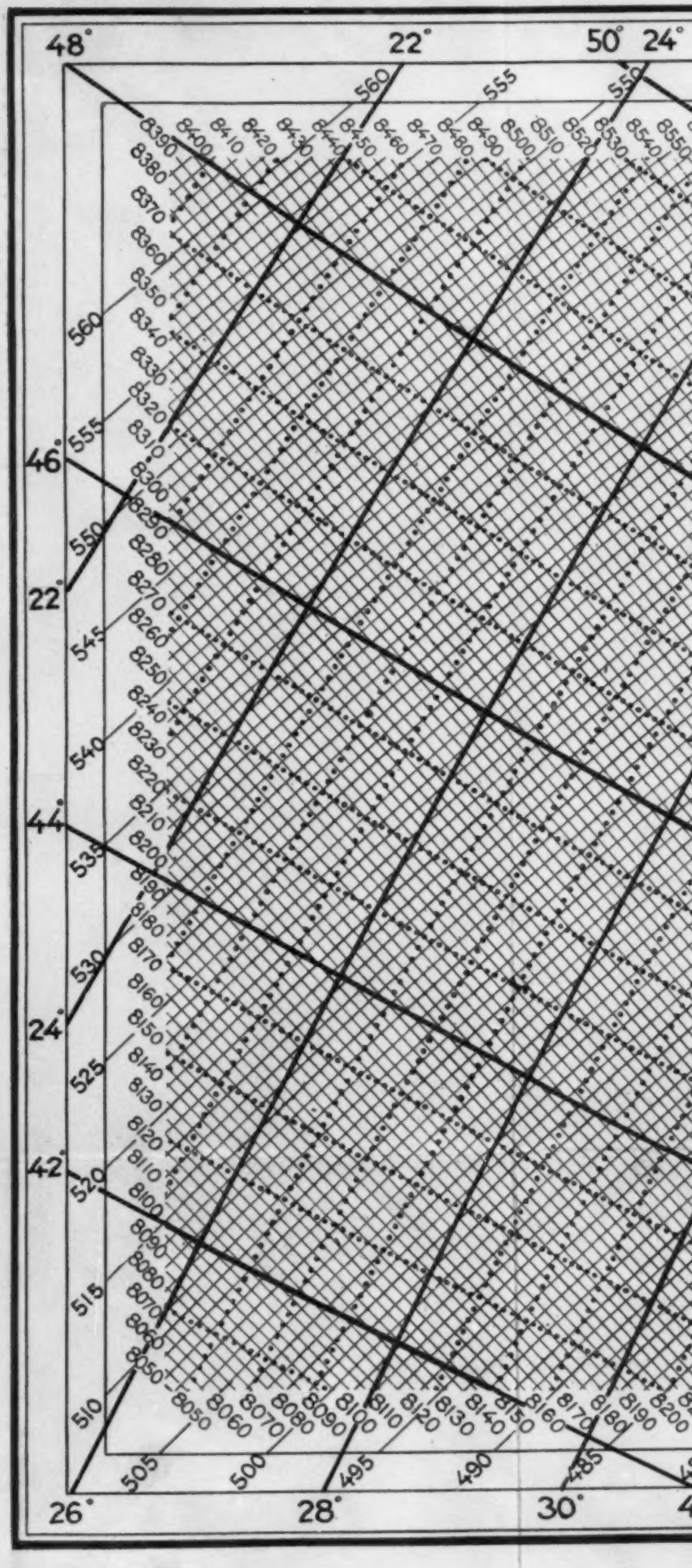
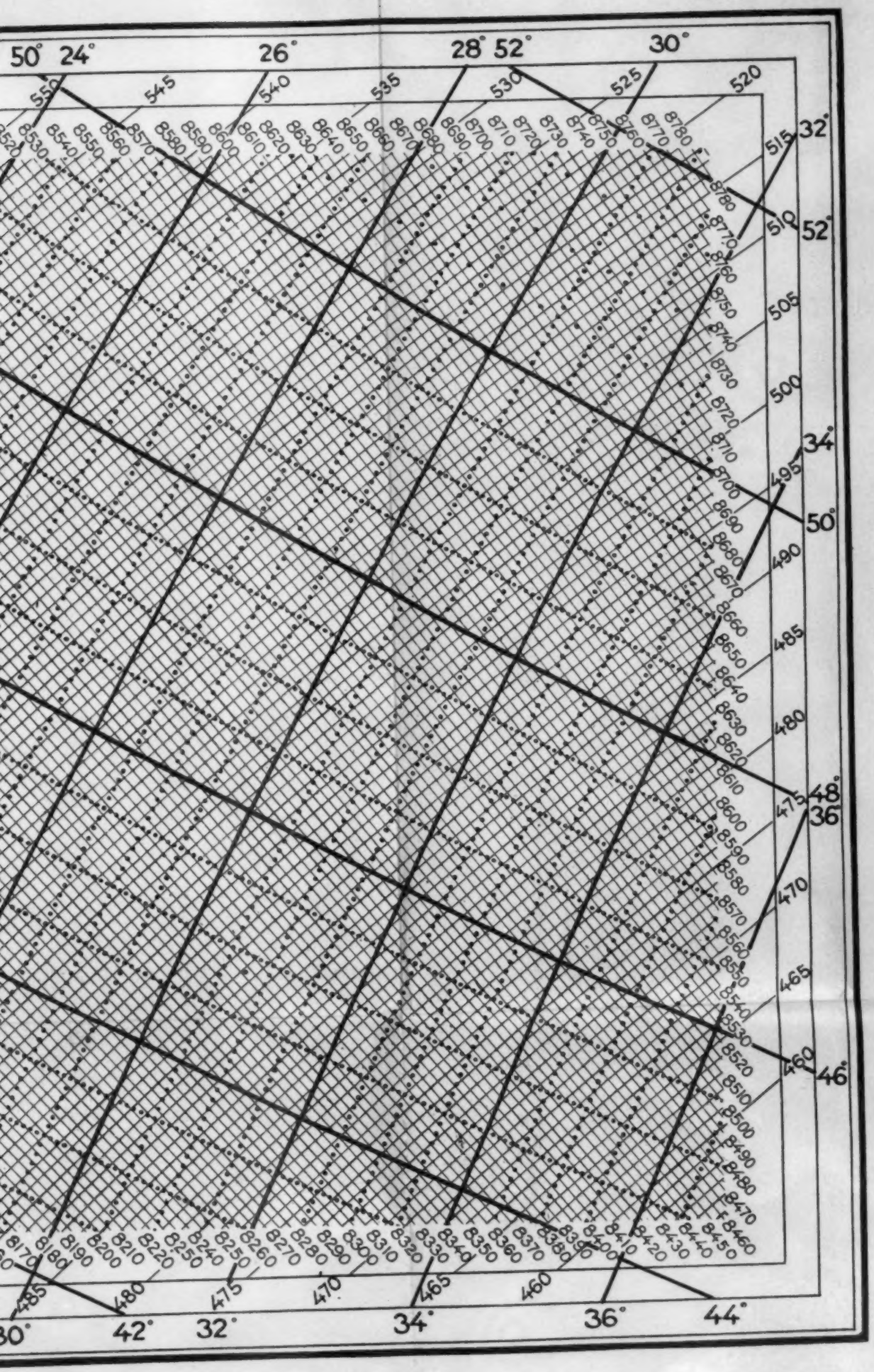

48°
22°
50°
24°
46°
22°
44°
24°
42°
26°
28°
30°

Plate 51


50° 24°
26°
28° 52°
30°
32°
52°
34°
50°
48°
36°
46°
44°
42°
32°
34°
36°
545
540
535
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470
465
460
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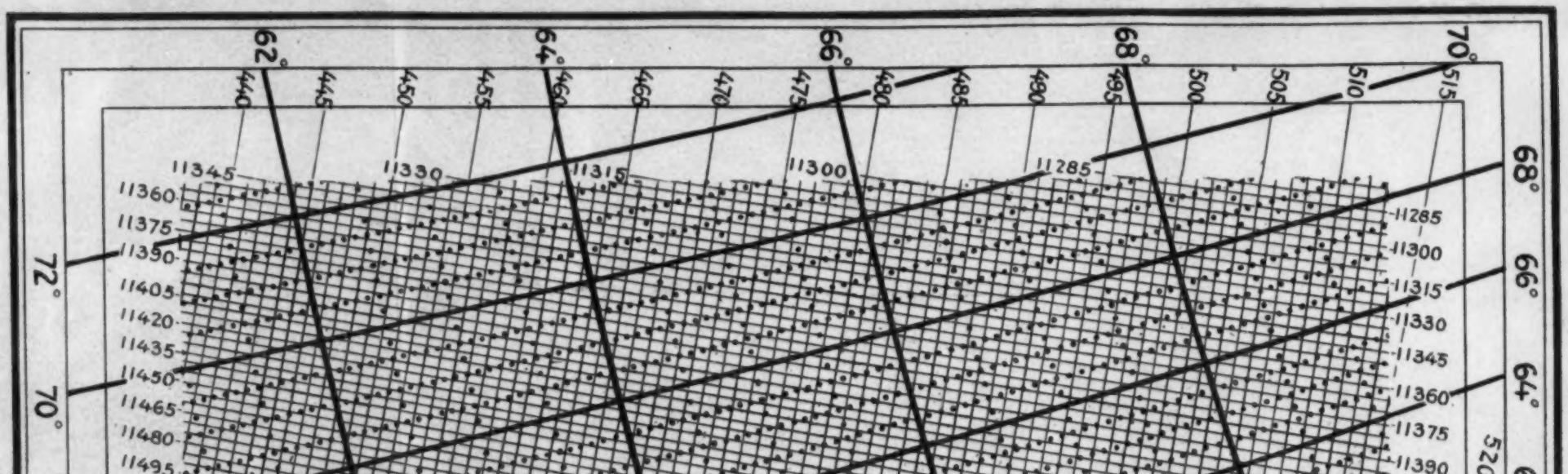
62°
64°
66°
68°
70°
72°
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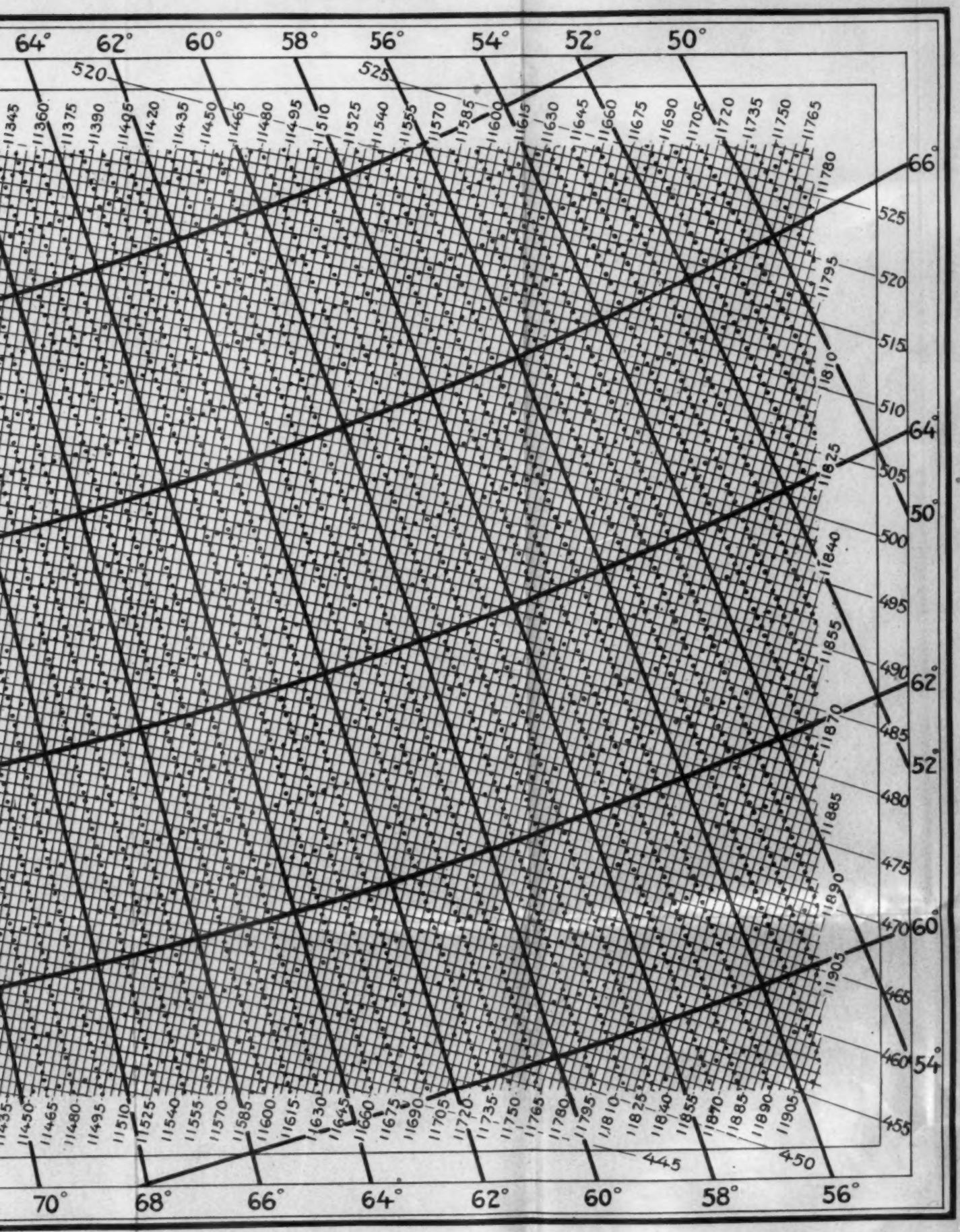
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
11345
11330
11315
11300
11285
11360
11375
11390
11405
11420
11435
11450
11465
11480
11495

Plate 136


64° 62° 60° 58° 56° 54° 52° 50°
520
525
66°
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60°
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54°
70° 68° 66° 64° 62° 60° 58° 56°
445
450

PROFESSIONAL NOTES.

Prepared by Professor PHILIP R. ALGER, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Armored Cruisers.			
Rivadavia	7,600	Genoa.	Under trial.
Moreno	7,600	"	Launched Feb., 1903.

These vessels have been purchased by Japan.

AUSTRIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Erzherzog-Karl	10,600	Trieste.	Launched Oct. 4, 1903.
B (ersatz-Drache)	10,600	"	Building.
C	10,600	"	To be laid down 1903.
Babenburg	8,340	Pola.	Under trial.
Armored Cruiser.			
E (ersatz-Radetsky)	7,400	Pola.	Building.
River Monitors.			
Save	450	Neupesth.	Nearly ready to be launched.
Theiss	450	"	" " " "

The new first-class armored cruiser E (ersatz-Radetsky), which was laid down in the Imperial Dockyard at Pola in 1900, is soon to be launched. Owing to a change in her armament her cost has been raised from 11,785,000 kronen (£491,041 13s.) to 12,785,000 kronen (£532,708 7s). Her dimensions are as follows: Length, 402 feet 6 inches; beam, 62 feet; draft, 21 feet 4 inches on a displacement of 7500 tons. Protection will be afforded by a water-line belt of Krupp steel, with a maximum thickness of 3.2 inches; the turrets for the guns will have the same thickness of armor, and the casemates for the secondary armament 5-inch; the armored bulkheads will be 7.6 inches thick, and the armored deck 1.5 inches. The armament is now to consist of two 9.4-inch guns in a turret forward; one 7.5-inch Q. F. gun in a turret aft; four 7.5-inch Q. F. guns, two forward and two aft, as bow and stern chasers in casemates; four 5.8-inch Q. F. guns on the beam in a central casemated battery; twenty-four 3-pounder and machine guns with two submerged torpedo tubes. The engines are to develop 12,300 I. H.P., giving a speed of 21 knots, the boilers being of the Yarrow water-tube type. The coal supply will be 820 tons, giving a radius of action of 2100 miles at 10 knots.

The new battleship Arpad, a sister ship to the Habsburg and Babenberg, has successfully completed her trials, and proved herself to be the fastest battleship at present afloat. During a six hours' run she maintained a

mean speed of 19.65 knots, the contract speed provided for being only 18.5 and the maximum speed attained was 20.12 knots. The ship was designed by Herr Popper, the Chief Constructor of the Austro-Hungarian navy, and she was built and engined by the Stabilimento Tecnico Triestino, at Trieste, the great firm where so many of the best ships of the Austrian navy have been constructed, and in whose hands the designing of the engines were left. Steam is provided by sixteen Belleville boilers, which have a grate area of 853 square feet, and a heating surface of 31,440 feet. Neither engines nor boilers gave the least trouble during the trials. The Arpad has been commissioned and has taken the place in the Evolutionary Squadron of the Budapest.—*Militär Zeitung* and *Marine Rundschau*.

CHILI.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Libertad	11,800	Barrow.	Launched Jan., 1903.
Constitucion	11,800	Elswick.	" " "

It is officially announced that Great Britain has purchased these two vessels. The price was £1,875,000, inclusive of all expenses. They will be named Swiftsure and Triumph.

FRANCE.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
République	14,865	Brest.	Launched Sept., 1903.
Démocratie	14,865	"	Building.
Patrie	14,865	La Seyne.	"
Justice	14,865	"	Ordered.
Vérité	14,865	Bordeaux.	"
Liberté	14,865	St. Nazaire.	"
Armored Cruisers.			
Ernest Rénan	13,562	Brest.	Building.
Jules Michelet	13,562	Lorient.	To be begun shortly.
Jules Ferry	12,550	Cherbourg.	Launched Aug. 23, 1903.
Victor Hugo	12,550	Lorient.	Building.
Léon Gambetta	12,550	Brest.	Lchd. Oct., 1901; com. 1903.
Gloire	10,014	Lorient.	Lchd. 1900; complete 1903.
Amiral Aube	10,014	St. Nazaire.	Under trial.
Sully	10,014	La Seyne.	" "
Condé	10,014	Lorient.	" "
Gueydan	9,516	....	" "
Dupetit Thouars	9,516	Toulon.	Lchd. July, 1901; com. 1903.
Desaix	7,700	....	Under trial.
Dupleix	7,700	....	" "
Kléber	7,700	....	" "

THE FAILURE OF THE JURIEN DE LA GRAVIÈRE.—Official reports received at the Ministry of Marine show that this vessel is likely to prove one of the failures of the French navy. We have before now often referred to the difficulty which was experienced in bringing her steam trials, which lasted over the best part of a year, to a successful conclusion.

Like the Guichen and Châteaurenault, she was built as one of the so-called "commerce-destroyers," with a displacement of 5685 tons, and was intended to have a speed of 23 knots. She was laid down as long ago as November, 1897, at Lorient, was launched in August, 1899, but it was not until last year that she was ready to begin her trials. She is fitted

with small-tube water-tube boilers, of the Du Temple-Guyot type, which from the very first gave an infinity of trouble, and it was only with great difficulty that she at last attained her designed speed of 23 knots during a two hours' run. She left Lorient for the West Indies on the 24th of July, with orders to cross the Atlantic at a speed of 15 knots, but before she had run twenty-four hours, she had expended over 100 tons of coal, her total supply when filled up everywhere being only 900 tons. It became necessary to ease down, first to 12 knots and then to 10. In his report, her captain says: "With ten boilers in use it was impossible to keep the engines working at 120 revolutions. The leakage of water from the tubes was continual, and they became so foul that it became necessary to reduce the revolutions first to 110, and then to 90, giving the ship a speed of only ten knots. The engineers complain that it is impossible to stoke properly, because the coal is distributed in 70 bunkers, of which 50 are for the reserve stock. The temperature of the engine room and stokeholds ranged from 100° to 150° Fahr., and the engineers and stokers had to be continually relieved, as they were unable to stand the heat. Although she is supposed to steam 23 knots, it is doubtful if she could maintain a speed of 20 knots even for three hours; she is supposed to have a radius of action of 9300 miles at 10 knots, when her full supply of coal, 900 tons, is on board, but as things are at present, her radius of action is but little over 4000 miles."

The French have been very unlucky with their 23-knot cruisers, not one of which, even when after long trials the 23 knots has been reached, has been able to maintain it. It may be remembered that the Guichen, the first to be completed, a vessel larger than the Jurien de la Gravière, by some three thousand tons, when ordered to China with all dispatch on the outbreak of the Boxer disturbances in the summer of 1900, was only able to make an average of 14.5 knots, and was beaten easily by the second class cruisers Dido and Isis, which were ordered from the Mediterranean to reinforce Sir S. Seymour's squadron at the same time.

NEW SHIPS AND DOCKYARD NOTES. CHERBOURG.—The new second-class battleship Henry IV has at last completed her trials, and her engines have been formally taken over; she will now be commissioned to take the place of the coast-defense ship Valmy in the Northern Squadron. During her last run, on the 4th ult., to test her machinery, some gun trials took place off Cherbourg, with the view of testing the habitability of the after main turret mounting the 274-mm. (10.8-inch) guns, while the 138-mm. (5.45-inch) gun in the upper turret over it was being fired. Some sheep were enclosed in the lower turret, and twenty rounds were fired from the upper gun. After the trial the sheep were all found alive, but in a dazed condition. Both the *Yacht* and *Petit Var* agree that the results of the firing were extremely unsatisfactory. Considerable difficulty seems to have been experienced in ramming the projectiles of the 27-cm. (10.8-inch) guns home, and it took forty minutes to fire five rounds from these guns, one round in eight minutes. The guns in question are 45-caliber guns, of the 1893-96 model. Originally the powder chamber was some 50-mm. diameter larger than the caliber of the gun, but the variations in the internal pressures of the smokeless powder were found to vary considerably, and some fear was expressd as to the resisting power of the breech-blocks, and with the view of diminishing the pressure upon them, the powder chamber was reduced until it was only 9 mm. larger than the bore; the weight of the charge was somewhat increased, and it was hoped that a high initial velocity would be secured, with an increased resisting strength in the breech-blocks. The result, however, is that it is now extremely difficult to load the guns. It seems also certain that the 5.4-inch gun in the upper turret cannot be fired over the complete arc without the risk of injury to the men working the 10.8-inch guns in the lower turret. —*United Service Institution.*

During manœuvres last week at Bizerta the French submarine Korrigan performed a feat which has given great satisfaction in naval circles. It made its way into the harbor at low tide, submerged at a depth of six feet, and threading all the intricacies of the channel against strong currents brought up in the inner port alongside of the admiral's flagship.—*United Service Gazette.*

Several French cruisers have lately been making successful trials. At Cherbourg the Amiral Aube, which is fitted with Belleville boilers of the economizer type, made a preliminary run of four hours with 14,000 H. P. The power was increased to 19,305 H. P., and the working of the Belleville boilers was completely satisfactory. The trials are not yet completed. The Desaix at the same port has completed her official twenty-four hours' trial of 10,000 H. P., 500 H. P. in excess being developed, and the coal consumption was moderate. In this cruiser, again, the boilers are of the Belleville type with economizers. The correspondent of the *Yacht* at Cherbourg is well pleased with the smooth working of the engines, the power produced and the small coal consumption, but does not give the speed attained. At Rochefort the Forbin has completed her twenty-four hours' trials satisfactorily, and is to be placed in the reserve. She changed her former boilers for others of the Niclausse type. Her appearance is altered, for she has now three funnels, of which two are large and one small, and no fighting tops.—*Army and Navy Gazette.*

It is announced that six submarine boats, with a submerged displacement of 450 tons, designed by M. Maugas, are to be put in hand for the French navy. These are to be submarines proper, but will be a vast improvement upon the Gustave Zède.—*United Service Gazette.*

The *Yacht* gives interesting particulars from the project of the French naval budget for 1904 in relation to the stations of the mobile defense. In this matter, at least, great progress has been made, and the results have surpassed expectations. Thus several of the changes intended for 1904 have already been introduced. The trials of destroyers and torpedo boats have been conducted more rapidly than in former times, and have been crowned with success, so that it is likely that next year will witness the completion of the program of organization of the stations, as provided under the decree of April 1, 1902. The main feature of the program of next year is the final constitution of the divisions, consisting of six torpedo boats, with a destroyer as their leader, instead of merely a seagoing boat.

In each center of the mobile defense, three hours after the order for mobilization, one or, in some cases, two divisions of six first-class or seagoing boats can leave the port led by one of the new destroyers of the Durandal type, and commanded by a lieutenant of twelve years' seniority, representing theoretically the "corvette captain" whose rank has not yet been created. Few second-class boats now remain in commission, and these will soon disappear. The 35-meter boats (115 feet) are getting worn out, and only Nos. 130 to 145 will remain useful for a few years, with certain 33-meter boats (108 feet 3 inches). Undoubtedly the French have rapidly increased in strength in this particular, and the organization of the coast stations has made great advances.—*Army and Navy Gazette.*

The navy estimates for 1903 totalled 306,692,678 francs (£12,267,630), as against 306,798,738 francs (£12,271,949) for the previous year. The total amount devoted to new construction was 89,100,000 francs (£3,564,000).

Personnel.—The number of men on the active list of the French navy during 1903 was 45,312, and the number of officers and men, 53,247. In the reserve there were 49,346 officers and men. The number of men effective during 1903 is less by 2940 than the number available in the previous year.

Matériel.—The strength of ships built, building and projected on October 31 was:

Built.

Battleships, 1st class	20
Battleships, 2nd class	9
Battleships, 3rd class	1
Coast-defense vessels	14
Armored cruisers	10
Protected cruisers, 1st class	7
Protected cruisers, 2nd class	16
Protected cruisers, 3rd class	17
Unprotected cruisers	1
Torpedo vessels	16
Torpedo-boat destroyers	14
Torpedo boats	247
Submarines	15

Building.

Battleships, 1st class	6
Armored cruisers	11
Torpedo-boat destroyers	23
Torpedo boats	43
Submarines	43

Projected.

Armored cruisers	2

In the above lists since the official return was published the battleship Suffren has been added to the completed list of first-class battleships, and the Henry IV to that of the second-class vessels. Of armored cruisers the Dupetit Thouars has been completed, and the Jurien de la Gravière, protected cruiser, has also been put in commission. The projected armored cruisers are the Jules Michelet, which is to be laid down at Lorient in the coming spring, and C 16, which is to be of the Ernest Rénan type, and will be built at Brest.

As we go to press a report from Paris fixes the proposed estimate for the navy for 1904 at 312,931,832 francs, of which it is proposed to devote 113,712,127 francs to new constructions and the completion of the old program.—*Page's Magazine.*

Owing to the indecision of the Minister of Marine, the new first-class armored cruiser Victor Hugo, one of the 1900 program and a sister-ship of the Leon Gambetta and Jules Ferry, will not be ready for launching at the earliest before next February, although the work on her is now being pushed forward with feverish haste; this ship was to have been built at Toulon, but it was then decided that she was to be constructed at this yard, with the result that she was only laid down and work on her commenced this last spring. Her framing is now all in place, with the transverse and longitudinal bulkheads, and the armored deck is being fixed. After she is launched, her place on the slip will be taken by the Jules Michelet, which is a vessel of a similar type, with some slight modifications, as her displacement will be increased by some twenty tons, and her engines are to develop 1500 I. H. P. more. More important will be the alteration in her armament, as two 9.4-inch guns are to take the place of the four 7.6-inch Q. F. guns, one being mounted in the turret forward and the other aft. The Jules Michelet will be a type between the Gambetta and the Ernest Rénan, which is to be 1000 tons more displacement, viz., 13,562, with engines developing 38,000 I. H. P., to give a speed of 23 knots; she was to have been built by contract by the Penhoët firm at St. Nazaire, but she is now to be built at Brest, the Penhoët firm making the boilers and machinery.—*United Service Institution.*

GERMANY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Mecklenburg	11,900	Stettin.	Under trial.
Schwaben	11,900	Wilhelmshavn.	Lchd. Aug., 1901; compl. 1903.
Braunschweig	13,200	Kiel.	Lchd; complete in 1904.
Elsass	13,200	Dantzic.	" May 26, 1903.
Preussen	13,200	Stettin.	" Oct. 31, 1903.
Hessen	13,200	Kiel.	Lchd. Sept. 15, 1903.
Lothringin	13,200	Dantzic.	Building.
N	13,200	Gaarden.	"
Armored Cruisers.			
Prinz Heinrich	8,868	Kiel.	Under trial.
Prinz Adalbert	9,050	"	" "
Prinz Friedrich Karl	9,050	Hamburg.	" "
Roon	9,050	Kiel.	Launched June 27, 1903.
E (ersatz-Deutschland)	9,050	Hamburg.	Building.
F	9,050	Kiel.	"
Protected Cruisers.			
Frauenlob	2,715	Bremen.	Under trial.
Arcona	2,715	"	" "
Undine	2,715	Kiel.	" "
Hamburg	3,000	Stettin.	Lchd. July 25, 1903.
Bremen	3,000	Bremen.	Lchd. July 9, 1903.
Berlin	3,000	"	Lchd. Sept. 22, 1903.

The German battleship K was launched on October 31 at the Vulcan Yard, Stettin, in the presence of the Emperor and Empress, and received the name of Preussen. She is a sister of the Braunschweig, launched in 1902, and of the Elsass and Hessen, which have taken the water this year. We have already described the class, and it may be enough to say that the displacement is 13,200 tons, the armament four 11-inch, fourteen 6.7-inch, twelve 3.4-inch, and twelve 1.4-inch guns, and the intended speed 18 knots. At the launch the Imperial Chancellor expressed gratification at the great progress now being made by the German fleet, owing to the strenuous initiative of the Emperor, the sacrifices accepted by the people, and the loyal co-operation of the federal states. The Empress christened the ship, which glided into the water without a hitch.

The personnel of the German Imperial Navy for 1904 has been fixed at 38,000 men, as compared with 35,500 for 1903. This shows that the strength in all ranks has been doubled since 1893, while the number of engineers has been trebled.—*United Service Gazette.*

The navy estimates for 1903 totalled £10,887,182, which was £853,208 more than that for the previous year. The sum to be devoted to new ship-building was £3,640,483.

Personnel.—The number of officers and men on the active list is 33,562, and on the regular reserve there are 5114. In all, however, there are about 70,000 men liable for service in the reserve. For 1904 the personnel has been fixed at 38,000 of all ranks.

Matériel.—The strength of ships built and building on October 31 was:

Built.

Battleships, 1st class	13
Battleships, 2nd class	4
Battleships, 3rd class	12
Coast-defense ships	11
Armored cruisers	2
Protected cruisers, 1st class	1
Protected cruisers, 2nd class	8
Protected cruisers, 3rd class	10
Unprotected cruisers	20
Torpedo vessels	2
Torpedo-boat destroyers	32
Torpedo boats	93
Submarines	—

Building.

Battleships, 1st class	7
Armored cruisers	4
Protected cruisers, 3rd class	7
Torpedo-boat destroyers	6
Torpedo boats	—

—*Page's Magazine.*

The battleship Preussen was launched October 31 in the presence of the Emperor and the naval authorities in Stettin at the Vulkan shipyard.

The cruiser Undine made her preliminary trials, that were entirely successful. The cruiser was built by the Howaldts Works at Kiel, and is one of twelve ranging from 2600 to 3250 tons displacement, which have been built by the German navy for scout service. Of the twelve, eight are in service, while the rest are building.

The armored cruiser Frederic Karl commenced her trials during October. Contract for this vessel was signed April, 1901. The keel was laid August 13, 1901, and she was launched June 21, 1902. She is a sister ship to the cruisers Prince Heinrich and Prince Adelbert. She has an armored citadel with casemates in front of it extending over about one-half of her length. The side armor has a thickness of about 4 inches, tapering to about 3 inches at the stem and stern. The citadel has a thickness of about 4 inches, which is also the dimension for the casemates. The armament of the ship consists of:

Four 8.2-inch, of which two are in armored turrets.
Six 6-inch in casemates.
Four 6-inch in turrets.
Twelve 3.5-inch.
Some 37-mm. and rifles.

Displacement	9000 tons.
Length	400 feet.
Beam	65 feet.
Draft	24 feet 2 inches.

The ship has twelve transverse bulkheads and one longitudinal bulkhead dividing her into 26 compartments. Her machinery consists of three triple-expansion engines working three screws with a maximum capacity of 17,000 I. H. P., which are expected to drive the ship at 21 knots per hour. There are 14 Duerr boilers and the bunkers can take 15 tons of coal. There are four searchlights, steam steering engine, pumps for drainage and fire service, boat crane and ammunition hoists. Electric light is provided in every room and the crew of the cruiser amounts to about 600 men.

The armored cruiser Roon distinguishes herself from the foregoing ship by being 10 feet longer, 2 feet wider and having 500 tons larger displacement, with an increased engine capacity of 2000 I. H. P.

All German warships wth the exception of the torpedo boats carry now carrier pigeons for purposes of communication. The Navy Department maintains carrier-pigeon stations in Wilhelmshaven, Kiel, and Heligoland, and is in connection with about 200 private clubs that own about 6500 carrier pigeons.—*Nautical Gazette.*

GREAT BRITAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Africa	16,350	Chatham.	Ordered.
Britannia	16,350	Portsmouth.	"
Hibernia	16,350	Devonport.	"
Hindostan	16,350	Clydebank.	Building.
New Zealand	16,350	Portsmouth.	"
Commonwealth	16,350	Glasgow.	Launched May 13, 1903.
Dominion	16,350	London.	Launched Aug. 25, 1903.
King Edward VII	16,350	Devonport.	Launched July 23, 1903.
Queen	15,000	"	Under trial.
Prince of Wales	15,000	Chatham.	" "
Armored Cruisers.			
Duke of Edinburgh	13,500	Pembroke.	Building.
Black Prince	13,500	Blackwall.	"
Warrior	13,500	Pembroke.	"
Cochrane	13,500	Glasgow.	Ordered.
Natal	13,500	Barrow.	"
Achilles	13,500	Newcastle.	"
Hampshire	10,700	Elswick.	Launched Sept. 24, 1903.
Devonshire	10,700	Chatham.	Building.
Roxburgh	10,700	Glasgow.	"
Antrim	10,700	Clydebank.	Launched Oct. 8, 1903.
Argyll	10,700	Greenock.	Building.
Carnarvon	10,700	Glasgow.	Launched Oct. 7, 1903.
Cornwall	9,800	Pembroke.	Launched Oct., 1903.
Suffolk	9,800	Portsmouth.	" Jan., 1903.
Lancaster	9,800	Elswick.	Under trial.
Protected Cruisers.			
Encounter	5,880	Devonport.	Launched June, 1903.
Topaz	3,000	Birkenhead (Laird).	" July 23, 1903.
Amethyst	3,000	Elswick (Armstrong).	Launched Nov. 5, 1903.
Diamond	3,000	Birkenhead (Laird).	Building.
Sapphire	3,000	Yarrow (Palmer).	"
Gunboats.			
Cadmus	1,096	Sheerness.	Launched April 29, 1903.
Clio	1,096	"	Under trial.
Scouts.			
Adventure	2,730	Elswick.	Building.
Forward	2,545	Fairfield.	"
Pathfinder	2,610	Birkenhead.	"
Sentinel	2,900	Vickers.	"
Skirmisher	2,900	"	"
Foresight	2,545	Fairfield.	"
Attentive	2,730	Elswick.	"
Patrol	2,610	Birkenhead.	"

It has now been practically decided that the three battleships to be built by contract under this year's navy program will be of the King Edward VII class, of which five have already been laid down—the name-ship, launched at Devonport in July; the Commonwealth, floated at Fairfield

in May; the Dominion, launched in August; the Hindustan, building at Messrs. Brown's works at Clydebank, and to be launched before the year is out; with the New Zealand, to be floated at Portsmouth n February. The two last named belong to a program one year later than the three others. We shall then have eight battleships of the same class—and a very good class, too. Each of the ships is 425 feet long, 78 feet beam and at 26 feet 9 inches draft they displace 16,350 tons. Their speed is 18½ knots, and their armament embodies an important improvement, including, as it does, four 12-inch, four 9.2-inch, and ten 6-inch guns. The many designs made at the admiralty during the past few months were, as a rule, intended to obtain a greater gun power. There were two main alternative schemes, it is stated—one to provide eight 9.2-inch guns by mounting a pair instead of a single gun in each secondary barbette at each corner of the citadel, and this arrangement found most favor. The other was to fit one 10-inch gun instead of one 9.2-inch in each of these secondary barbettes—a system preferred by the Japanese naval authorities for their new battleships. But it has been decided to adopt the general characteristics of the King Edward VII class partly to save time. The specifications will be issued to prospective tenderers soon. It may be as well to state clearly that the idea of increasd size was not a deciding factor, as this must ever be justified by improvements in offensive and defensive qualities.

The orders for the construction of the three new first-class armored cruisers, of the Duke of Edinburgh type, have now been placed. They will be named the Achilles, Cochrane and Natal, and will each have a displacement of 13,550 tons, and will be fitted with engines of 23,500 horse power, propelling them at a speed of 22.33 knots per hour. The Achilles will be built by Messrs. Armstrong, Whitworth & Co., the Cochrane by the Fairfield Shipbuilding and Engineering Company, and the Natal by Messrs. Vickers, Sons & Maxim. Each cruiser will be armed with ten 9.2-inch and ten 6-inch breech-loading guns and twenty-eight small quick-firing guns. The cruiser Achilles succeeds to the name borne by an old armored cruiser built forty years ago, and long since ineffective. The Cochrane will, of course, bear the name of the famous fighting admiral, the ancestor of Lord Dundonald, who destroyed Napoleon's fleet in Basque Roads in 1809, and won fame afterwards in the wars for the independence of Chili and Peru, and is remembered with affection by the Brazilians, whom he also gallantly aided. The colony of Natal is now to figure in the British fleet, being inscribed on the navy list, side by side with the Australia, the New Zealand, the Good Hope, and the Dominion, while, as stated above, a battleship of 16,350 tons, to be christened the Hindustan, is being built at Clydebank. The colony of Natal has just begun to make a direct contribution to the fleet of £35,000 a year, which is a greater sum per capita than is given by any other of the self-governing colonies.

The admiralty has also placed orders for four new "scouts" to be built for the Royal Navy by contract. They are to be named Attentive, Foresight, Patrol, and Skirmisher, and are to steam 25 knots per hour, and will be armed with ten 12-pounder quick-firing guns. The Attentive will be built by Messrs. Armstrong, Whitworth & Co., of Newcastle-on-Tyne; the Foresight by the Fairfield Shipbuilding Company; the Patrol by Laird Brothers, of Birkenhead; and the Skirmisher by Messrs. Vickers, Sons & Maxim.

Further, the Admiralty have placed the orders for the fifteen torpedo-boat destroyers included in this year's naval program, and the contracts have been given to firms who have made this type of craft a specialty. Three of the boats are to be built by Palmer's Company, Jarrow-on-Tyne, who have had a long series of successes; three are to be built by Messrs. Laird, of Birkenhead, another firm who have attained their 25½ knots with the vessels ordered a year ago; another three are to be constructed by Messrs. Hawthorn, Leslie & Co., Newcastle; three by Messrs. Thorneycroft, of London, and two by Messrs. Yarrow, of London. The fifteenth

vessel will probably be a boat of special design, now in an advanced stage of construction. It is understood that three of the vessels, those ordered from the Jarrow firm, will be fitted with enclosed engines, with the company's patent system of forced lubrication, which was adopted in the Syren with excellent results. The Syren, which was built at Jarrow in 1902, is at present the only vessel in the navy so fitted.

According to an article in a recent issue of *Engineering*, the latest type of British submarine boats constructed by Messrs. Vickers, Sons & Maxim, Ltd., has an under-water speed of between nine and ten knots, and is a much modified development of the original Holland type. The length is about 150 feet for the new boats and 120 feet in the original. The new type has a radius of action of 500 miles, and the original one of about 300 miles. Even the latter, however, weigh about 120 tons, and cannot therefore be carried on shipboard. The maximum size which it will be possible to build will probably not exceed 250 feet in length. Submergence in practice evolutions commonly lasts three hours. The new type of boat successfully weathered an unusually heavy gale off the Lizard this summer. The quarters are, however, very cramped. Indeed, when below, the crew must keep fixed stations, or the displacement of the center of gravity might cause the boat to make an unintentionally deep plunge. It is suggested that the boats should be provided in sets of three, each of which would have three days on duty and six days off, thus preserving the health of the crew. The success of these craft has rendered impossible the blockade of any port. The only safety for an ironclad at rest is behind a close range of fixed mines, but these must be well in advance of the ship protected, as the useful range of the torpedoes carried by the submarines is 2000 yards. When in motion battleships and cruisers will form a less easy prey, since the speed of the submarines is never high. They are, however, exceedingly difficult to detect. The periscope tube through which the target is reflected down to the steersman below, only projects some 18 inches above water, and is thus very difficult to see. The only means of counter-attack at present available is a spar torpedo-boat. The idea is that these boats, being much faster than the submarine, may steam behind it, and, lowering the torpedo against it, may blow in its upper plating. This plan, however, will not be easily carried out, as the boat cannot steam fast with the spar lowered, and if they stop for the purpose the submarine will in the meantime slip away. Moreover, the new-type periscopes have an all-round vision, so that the spar torpedo could not steal up unperceived, and the submarine could then sink entirely out of range. High-explosive shells would have to be burst extremely close to them to do any damage. Navy men hold that the development of these boats has, for the present at any rate, rendered an invasion of these islands absolutely unpracticable.—*United Service Gazette.*

The Admiralty have decided to adopt Yarrow boilers for supplying steam for four-fifths of the power in each of the four new cruisers of 23,500 I. H. P., the remaining fifth of the boiler installation to consist of cylindrical boilers. The orders for three of these cruisers have been placed, one each with Messrs. Vickers, Sons & Maxim, Armstrong, Whitworth & Co., and the Fairfield Company, as announced in *The Times* of September 29. The machinery for the vessel of the Armstrong Company is to be constructed by Messrs. Hawthorn, Leslie & Co. The fourth cruiser is to be built at Pembroke Dockyard, and the Wallsend Slipway will supply the engines, whilst the boilers will be constructed by Messrs. Yarrow & Co. The decision of the Admiralty to place the Yarrow boiler in vessels of this large power is a step in advance for the type of boiler with small diameter tubes, placed approximately in a vertical position; for, although the tubes in the new boilers will be rather larger than those in the so-called "express" boilers, such as are used in torpedo craft, and the thickness of the metal will, it is said, be greater, yet they will be considerably less

in diameter than the tubes of the horizontal type, such as the Belleville, Babcock & Wilcox, or Niclausse boilers, hitherto generally fitted in the heavier powered war vessels.—*London Times.*

The experiments on the use of the turbine for the propulsion of our ships of war are being made continuously by the Admiralty. Hitherto no vessel of larger dimensions than a destroyer has been fitted with it, but on Thursday afternoon, November 5, the Amethyst, the first cruiser to be propelled by turbines, was launched at Elswick. She is not a very big ship, being rated only third-class, but she will, nevertheless, give more scope for a thorough test of the turbines than the smaller vessels afforded; and it is to be hoped that the tests will be of a very searching kind. Whilst the turbine was comparatively little known there were few to oppose it, but since it has gained notoriety on shore and at sea its critics are increasing in number and activity, and are producing facts, figures, and allegations that demand absolute and decisive answers, and the Amethyst must be prepared to stand up to, and reply to, the heckling of these critics.

She is 360 feet long by 40 feet broad. Her molded depth is 21 feet 6 inches, and her mean draft is 14 feet 6 inches. She will displace about 3000 tons. Her armament will consist of twelve 4-inch, eight 3-pounder quick-firers, two Maxims, and two 18-inch above-water torpedo tubes. Her protection consists of a steel deck all fore and aft.

She will have three screw shafts, driven by Parsons' compound steam turbines. The outer pair will have astern as well as the ahead turbines on their shafts. The total horse power will be 9800.

Her boilers will be of the Yarrow type. She is expected to attain a speed of 21¾ knots.—*Engineer.*

On September 15, at Chatham, five old naval vessels were offered for sale, and four of these found purchasers. The first was the battleship Inflexible, built in 1881, and there was a spirited competition for her. Eventually she fell to Mr. J. Ward, of Sheffield, for £20,100. The second-class battleship Neptune, originally bought from the Brazilian Government for £713,196, was sold to a London broker for £18,000. Both these vessels are to be broken up within stated periods, and the Admiralty offer to buy back the Inflexible's turrets for experimental purposes. There is no restriction as to the ships being taken away from British waters. The second-class torpedo boat No. 72 was sold for £110, and the hulk Enterprise, lying at Stromness Harbor, Orkney, fetched £405. The old coast-guard cruiser Argus, however. failed to find a purchaser, the highest sum offered being £750. The berthing accommodation at Portsmouth is rapidly being improved by the removal of these old hulks, and with the passing of the depot ships, which at present house the men of that port, there should be no more complaints of overcrowding.—*Army and Navy Gazette.*

There is every probability that the first of the new torpedo-boat destroyers ready for official trials will be the Erne, the prototype of the five launched from Palmer's Shipbuilding Company's works, at Jarrow-on-Tyne. The Erne was afloat about three months ago, and since then the firm have been carrying out a most interesting series of trials. Marked success had attended the long list of 27- and 30-knot destroyers built at the works, and the experience gained was valuable in determining the arrangement necessary to meet new conditions consequent on changes in form owing to greater weight. The dimensions were limited to 235 feet long, with a beam of 23 feet 6 inches, and the designed displacement was 540 tons with a draft of 10 feet. The limit of power was specified as 5 per cent in excess of that stipulated as necessary for the 25½ knots. Messrs. Palmers named 7000 I. H. P. as sufficient; other firms ranged up to 7500 I. H. P., but improvements made by the Admiralty in all the ships

have increased the displacement since they were designed, so that the power required is slightly greater. The Erne did not at first realize her speed. That is also the case with the boats of the other firms entrusted with the building of this new class of destroyer, the propeller problem being the principal obstacle. But Messrs. Palmers attained success in their fourth set of propellers, and, peculiarly enough, the change as compared with the first set was only a 3-inch decrease in diameter and a 5 square feet increase in surface. Yet it added a sea-mile to the speed per hour for the same power. Messrs. Palmers have also gone into the question of the effect of bilge keels on speed. The vessels of the class were to have bilge keels 7 inches deep, extending for about half of the length of the vessel. The midship section, by the way, is very fine, having a very considerable rise of floor. The effect of these bilge keels was demonstrated by comparative trials, first with the bilge keels as originally stipulated, and subsequently with the keels removed, all the other conditions being the same. It was found that without the keels the speed was almost exactly three-quarters of a mile per hour greater. An increase was to be expected, but it is a very considerable one. The Erne, now at her full-load draft, has topped 25¼ knots speed for a little under 7700 indicated horse power.—*United Service Gazette.*

The navy estimates for 1903-4 were £34,457,500, being an increase of £3,202,000 over the estimates of the previous year. This is the sum actually estimated as the cost of the navy, including the non-effective services, but excluding other charges which fall under the estimates for the civil service and revenue department, which amount to about £300,000, and excluding also the cost of permanent works provided for under the naval works bill. Out of the first-named sum £10,136,430 is provision for new construction, which is £1,077,910 more than the sum voted for this purpose last year.

Personnel.—The number of officers, seamen, boys, and marines, and others provided for sea and other services amounts to 127,100, showing an increase of 4600 on the previous year.

Matériel.—The strength in ships built, building and projected on October 31 was:

Built.

Battleships, 1st class	47
Battleships, 2nd class	4
Battleships, 3rd class	2
Coast-defense ships	2
Armored cruisers	24
Protected cruisers, 1st class	21
Protected cruisers, 2nd class	51
Protected cruisers, 3rd class	32
Unprotected cruisers	10
Torpedo vessels	34
Torpedo-boat destroyers	112
Torpedo boats	85
Submarines	9

Building.

Battleships, 1st class	7
Armored cruisers	13
Protected cruisers, 2nd class	2
Protected cruisers, 3rd class	4
Scouts	4
Torpedo-boat destroyers	19
Torpedo boats	5

Projected.

Battleships, 1st class	6
Armored cruisers	4
Protected cruisers	3
Scouts	4
Torpedo-boat destroyers	15
Submarines	10

These tables are founded on the official return published in May last. They differ in some particulars, however, the battleships built being now five more in number than they were then. These five vessels are the Duncan, Albemarle, Russell, Exmouth, and Montagu. Six armored cruisers have also been completed, the Euryalus, Monmouth, Kent, Essex, Donegal, and Bedford.

All the vessels given in the projected list, except three battleships, belong to the program of 1903-4, these three battleships being vessels which Mr. Arnold-Forster announced in the House of Commons are to be laid down at each of the three principal dockyards in April next.—*Page's Magazine.*

The question of the distribution of responsibility for the efficiency of machinery and mechanical appliances in his Majesty's ships has been under the consideration of the Admiralty for some time past, and their Lordships have approved of a scheme which has come into operation this month in the ships of the Channel fleet. The scheme provides that the engineer officer will have charge of, and be responsible for, all machinery, however driven, in engine rooms and boiler rooms (except as regards the efficiency and repairs of the dynamos), and all steam, oil, and gas-driven machinery, wherever situated. He will also have charge of any hydraulic machinery which is not specifically detailed as being under the care of the gunnery or torpedo lieutenant. He is to be regarded as the mechanical expert of the ship, and, under the captain's direction, may be empowered to inspect any of the mechanical fittings not in his charge, and report to the captain on their efficiency.

The gunnery lieutenant will have charge of, and be responsible for, all guns, gun mountings, and machinery in connection with them, including firing gear and night sights, except where the machinery referred to is a steam, oil or gas engine.

The torpedo lieutenant will have charge of, and be responsible for, all torpedoes, torpedo tubes, and gear in connection with them outside the point where the engineer's responsibility ends. He will have charge of, and be responsible for, all electrical machinery in the ship not in the care of the engineer or gunnery officer, of all lighting and power circuits, of all bell and communication circuits, and is to repair all electrical instruments. The torpedo lieutenant is to be regarded as the electrical expert, and will be held responsible for the electrical efficiency of the ship. Under the captain's directions, he may be empowered to inspect any of the elecrical fittings and machinery of the ship and report to the captain on their efficiency. The captain will be responsible that the necessary engine-room staff is told off as required to assist the gunnery and torpedo officers in the care of the machinery under their charge.

The engineeer's workshop in charge of the engineer officer is to be considered the main workshop for any mechanical repairs that may be necessary throughout the ship, and the engineer officer is to carry out all mechanical repairs, of whatever nature, that cannot be dealt with by the armorers' or torpedo staff. The gunnery and torpedo staffs are not required to carry out large mechanical repairs, and the captain will be responsible that the engineer officer has such repairs done expeditiously by the engineering staff when duly requisitioned. If the gunnery department requires any repairs necessitating the use of the main workshop machines the gunnery officer is to requisition the engineer staff, who will,

after consultation with the officer in charge of machinery, direct and carry out the work as necessary. It is further provided that if any machinery in charge of the engineer or gunnery officer fails electrically, the torpedo staff is to be requisitioned to repair it. Similarly if any electrical machinery outside the engine room develops a mechanical defect, which the torpedo staff is unable to repair, the engineering staff is to be requisitioned, and they will direct and carry out the necessary work.

These regulations are to apply, for the present, only to ships on which gunnery and torpedo lieutenants are borne. In other ships the existing arrangements are to remain in force. Their Lordships state that while relying on the loyal co-operation of the officers concerned to carry out this new arrangement of duties, they are fully aware that a certain amount of elasticity must be allowed during the transition stage, and the regulations are, therefore, to be observed in the spirit, and not only in the letter, should exceptional circumstances arise.—*United Service Gazette.*

In the May number of this magazine I referred to the fact that the new college at Osborne, intended for the naval cadets to be trained under the new scheme, would be opened in the autumn. As a matter of fact, the youngsters joined on September 14, and the course of instruction began on the following day. * * * * * * * * * * * * * *

It is well to remember that not only in point of age but in the matter of selection, an entirely new plan has been carried out in regard to these cadets who have just gone to the college. The age has been lowered by something more than two years; indeed, some of the youngsters who presented themselves among the nearly three hundred candidates to be examined were very little over eleven. An official list has been published of the schools from which the eighty selected candidates were drawn, and this shows the very wide field that has been opened up. The plan of selection followed was to bring each candidate before a committee, which consisted of two naval officers, one a Lord of the Admiralty, and the other one who had had considerable experience in the training of cadets, a schoolmaster with at least twelve years of experience at Harrow, and a civilian official at the Admiralty who has for long been connected with the previous arrangements for selecting applicants for nominations. Each boy also brought with him a statement from the family medical adviser of his previous history, and also a report from his schoolmaster, framed on specific questions supplied to him. These reports formed the basis for selection, and, in addition, each youngster was given a couple of popular subjects on which to write a short essay to test his handwriting, spelling, and powers of expressing himself. As an example of the subjects chosen, and the result, it may be mentioned that one boy who was three months short of twelve years of age, was asked to explain what he thought were the chief duties of a naval officer. He wrote: "First, to serve his king and country; secondly, to be the last person to leave his ship if she were wrecked; thirdly, to obey his superior officers." It would be difficult for any grown man to put the matter more tersely.

The second test consisted of a series of simple questions on all kinds of subjects, chosen so that they should not be beyond the capacity of a boy of twelve. Many of these questions and the answers they elicited have been published; they go to show that, as a rule, in fact, with very few exceptions, indeed, the boys were quickly at their ease, and answered the questions put to them frankly and without any nervousness. The report of the examiners and of the Director of Naval Education who was present at many of the meetings of the committee, is said to have been unanimous as to the fairness of the method of selection, and its generally satisfactory nature.

The boys thus chosen have now gone to Osborne, and have entered upon a course of school training, the principles of which I explained in my

notes in the June issue. The education of a naval officer has been compared to the making of naval rope, in which there are three strands laid together and a small thread of colored stuff running through the strands indicating that it is government property. In times now gone by, the three strands represented the three subjects: Seamanship, Navigation and Gunnery, while the little colored thread stood for that sea aptitude which is imparted by an early familiarity with the actual conditions of life afloat. The strands of rope may be separated, or the rope severed, but the little colored thread cannot be entirely picked out; once woven with the rope, it remains forever. The result of the new training is to substitute a new strand for an old one. The scientific training of an engineer takes the place of that scientific training which was connected with the sailor's art. Seamanship remains, in so far as it belongs to the sea aptitude, and in so far as it is connected with practical navigation, but for the purpose of illustration, it may be said that the three strands are now Engineering, Navigation and Gunnery, instead of what they were when masts and sails and all that pertained to them filled such an essential function in the making of a seaman.

How these strands are to be woven together the course of instruction at Osborne shows. The novel feature in the school work is, of course, the engineering studies, which it is arranged shall be directly connected with the teaching of mathematics, physics, and the applied sciences, so that the minds of the cadets shall be prepared by one course for another. Practically, this means that there will be an alternation of theoretical work, with the studies carried out in the machinery shops and laboratories. The change and variety of occupation should stimulate and encourage the faculties of the cadets, and great interest attaches to this portion of the scheme. Apparently the classes will not consist of more than fourteen or fifteen boys, and when it comes to practical instruction not more than a third of this number. The lessons, too, are to be limited in length to about three-quarters of an hour for each of the theoretical subjects. Fifteen lessons during the week will be devoted to practical engineering, which includes the handling of machinery in the instructional steamboats, the use of tools in the workshops, and lectures on the parts of the engines and the elementary theory of steam machinery. The other subjects in which instruction will be given concurrently will receive attention according to their place in the following list: mathematics coming first, and French next, then history, mechanics, and practical physics, the remainder of the time being devoted to geography, English grammar and composition, English literature, and a study of the Bible. It will be noticed that neither Latin nor Greek are included in the curriculum. With regard to seamanship, navigation, and drill, subjects which are not mentioned above, these, of course, find a place in the scheme, at least one hour a day will be devoted to them, while, in addition, opportunities for acquiring a knowledge and experience in this connection will be given by trips of a week's duration in the training cruiser attached to the college. And during these cruises the ordinary studies are not to be interrupted.

Naturally, the scheme here outlined is and must be, more or less in the nature of an experiment at first. As time goes on modifications may become necessary, but, in any case, the result will be looked forward to by all interested in education and the training of youth, with the greatest interest. For the present it does not appear to be decided whether the boys shall go on from Osborne to Dartmouth; indeed two years must pass before the matter requires to be settled. And then the course of studies at the Britannia College will also need some alteration and expansion if indeed this does not happen before.—*Page's Magazine.*

ITALY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Roma.....	12,625	Gov't Yard, Spezia.	Building.
Napoli.....	12,625	Gov't Yard, Castellamare.	"
X	12,625	Gov't Yard, Venice.	Projected.
Vittorio Emanuele.....	12,625	Gov't Yard, Spezia.	Launched Sept. 29, 1903.
Regina Elena.....	12,625	Gov't Yard, Castellamare.	" Oct. 21, 1903.
Benedetto Brin...	13,526	Gov't Yard, Castellamare.	Launched Nov. 7, 1901.
Regina Margherita.....	13,526	Gov't Yard, Spezia.	Under trial.
Armored Cruiser.			
Francesco Ferruccio.....	7,460	Gov't Yard, Venice.	Launched April 30, 1903.
Torpedo Cruiser.			
Coatit.....	1,313	Gov't Yard, Castellamare.	Under trial.

The Italian battleship Vittorio Emanuele, a sister of the Benedetto Brin and of the Regina Elena, which are now in hand, was launched at Spezia on September 20. She is one of the new class, 12,624 tons, built somewhat upon cruiser lines, and intended to steam at 22 knots. Her engines are of 20,000 horse-power, and she has Belleville boilers. The length is 435 feet, 6 inches, the beam 73 feet 6 inches, and the draft 27 feet 4 inches. The ship is well protected by a belt having a maximum thickness of 9.7 inches, and by 6-inch plating for the battery, 4-inch for the deck, and 8-inch for the bulkheads. There are to be two 12-inch turret guns, with 8-inch protection, twelve 8-inch coupled in six turrets, twelve 3-inch and twelve 18-inch, as well as four torpedo tubes, of which two are submerged. The coal supply will be 1000 tons, but can be doubled if necessary.—*Army and Navy Gazette.*

On October 21 the Italian battleship Regina Elena was launched at Castellamare. She is a sister of the Roma, which was launched in September, and belongs to that class which has won approval from so many writers.—*United Service Gazette.*

According to a report laid before the Chamber by the Minister of Marine, a considerable delay has been caused in the completion of the new first-class battleships Regina Margherita and Benedetto Brin through the non-delivery of the armor at the contract date; the first-named ship is, however, now so far complete that she has arrived from Castellamare, at Naples, to receive her guns, and it is hoped that she will be ready for commissioning before the end of the year; the Benedetto Brin, completing at the same yard, will, however, hardly be ready before next May. The new battleships Vittorio Emanuele, building at Spezia, and the Regina Elena, at Castellamare, are making fair progress, but have also been delayed by the non-delivery of material. The two new battleships A and B, to be built at Spezia and Castellamare, respectively, to be named the Roma and Napoli, have not yet had their keels laid, but a good deal of material is ready, and as they are to be commenced immediately, it is hoped that they may be completed by the end of 1906, or at latest by the midsummer of 1907; the Roma is to be supplied with Belleville and the Napoli with Niclausse water-tube boilers, as the result of the experiments carried out by the Varese and Garibaldi. Considerable delay has also taken place in the construction of the new first-class armored cruiser Francesco Ferruccio, due partly to alterations having been made in the original designs. The first-class battleship Italia, which was launched in 1880, is to be thoroughly repaired and reconstructed, and she has been sent to the dockyard at Tarento for the purpose; she is to receive twelve new locomotive boilers in place of her old ones, among other changes.—*United Service Institution.*

JAPAN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
1, 2, 3	15,000	.....	To be built 1904–1909.
Armored Cruisers.			
1, 2, 3	9,900	.....	" " "
Protected Cruisers.			
3, 4	5,000	.....	" " "
Nitaka	3,470	Yokosuka.	Launched.
Tsuchima	3,470	Kure.	Building.
Otawa	3,000	Yokosuka.	"

RUSSIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Emperor Paul I	16,000	St. Petersburg. (Baltic Yard.)	Building.
Andrei Pervosvannui	16,000	St. Petersburg. (Galerney Island.)	"
X	16,000	.....	Projected.
X	16,000	.....	"
X	16,000	.....	"
Imperator Alexander III.	13,516	St. Petersburg.	Under trial.
Borodino	13,516	"	Launched Sept., 1901.
Orel	13,516	"	Lchd. July, 1902; compl. 1904.
Kniaz Suvarof	13,516	"	Lchd. Sept., 1902; compl. 1904.
Slava	13,516	"	Lchd. Aug. 29, 1903.
Evstafi	12,500	Nicolaiev.	Building.
X	12,500	"	"
Ivan Zlatoust	12,500	Sevastopol.	"
Coast Defense Iron Clad.			
Admiral B[illegible]kof	6,000	St. Petersburg.	Building.
Protected Cruisers.			
Oleg	6,750	St. Petersburg.	Launched Aug. 27, 1903.
Kagul	6,750	Nicolaiev.	Launched June 2, 1903.
X	6,700	"	Building.
Otchakof	6,750	Sevastopol.	Launched Oct., 1902.
X	6,750	"	Building.
Vitiaz	6,750	St. Petersburg.	Building.
X	6,750	"	"
Boyarin	3,200	Copenhagen.	Under trial.
Kalgoula	3,200	Nicolaiev.	Building.
Almaz	3,200	St. Petersburg.	Launched June 2, 1903.
Zemtchug	3,200	"	Launched Aug. 27, 1903.
Izumrud	3,200	"	Launched Oct. 24, 1903.
7	3,200	Dantzic (Schichau).	Building.
8	3,200	St. Petersburg.	Projected.

On August 29, there was launched at the Baltic Shipbuilding Yard the Slava, the last of the five first-class battleships of the 1898 program building in the Russian Baltic Yards, to take the water. Her dimensions are as follows:—Length between perpendiculars, 367 feet 5 inches; length over all, including ram, 398 feet 1 inch; extreme beam, with sheathing, 76 feet; draft, on an even keel, 26 feet; displacement, 13,516 tons; I. H. P. of engines, 15,800; speed, 18 knots; total coal capacity, 1250 tons. The first part of the keel was laid on November 2, of last year. The vessel will

mount four 12-inch, twelve 6-inch Q. F., twenty 12-pounders, twenty 3-pounders and eight 1-pounder guns, in all 64; the 12-inch guns are mounted in pairs in turrets, one forward and one aft; protected by 11-inch armor, with 10-inch ammunition hoists; the 6-inch guns are mounted in pairs in turrets, protected by 6-inch armor, with 5-inch hoists, the three turrets each side being on the bow, beam and quarter. Protection is afforded by a 9-inch water-line belt, tapering to 4 inches at bow and stern; this belt extends from 1 foot 6 inches above the water to 5 feet below. Above this belt is a second, 6 inches thick, and 5 feet high, which, however, does not protect the main deck. There are two armored decks, the lower, 3 inches thick on the flat, curves down each side to the double bottom at the turn of the bilge, the thickness being increased to 4 inches on the curve and sides, as a protection against torpedoes, this steel wall extends from the bow to just abaft the after magazines. The longitudinal armored bulkhead is one of the most notable features in the Slava and her four sisters, and is also found in the Tsarevitch, another of the class built at the La Seyne Yard, Toulon. The upper armor deck is two inches thick. The torpedo equipment will consist of one above-water and 4 under-water ejecting tubes. The armor is mostly of native production. There are in all some 167 water-tight compartments. The total weight of steel and armor employed is some 108,000 cwt. The triple-expansion four-cylinder engines were constructed on the same designs as those of the Imperator above-mentioned, the Oriel and Kniaz Suvaroff, and are estimated to develop 15,800 horse-power. They and the Belleville boilers are being constructed by the Baltic works. The latter are twenty in number, this being the eleventh ship whose boilers have been built at the yard, and are placed in two compartments, forming four stokeholds.

Of the other six ships of the 1898 program, the Retvisan, built at Cramp's Yard, Philadelphia, was completed last year; the Tsarevitch, as we state elsewhere, was completed last August; the Imperator Alexander III, building at the Baltic works, St. Petersburg, which was laid down in September, 1899, and launched in August, 1901, is approaching completion; the Orel, laid down at Galernii Island, St. Petersburg, in June, 1900, was launched in August of last year, and the Borodino, laid down in May, 1900, at the New Admiralty Yard, St. Petersburg, was launched in September, 1901; both of these ships will, it is expected, be completed next spring; while the Kniaz Suvaroff, also building at the Baltic works, which was laid down in September, 1901, launched in September, last year, will hardly be completed before the end of 1904.—*United Service Institution.*

As we said last week, further particulars concerning the Russian ship-building program must soon be published. The Ivan (or Ioann) Slatoust and the Evstafi, which have been laid down in the Black Sea, belong to the class of the more recent vessels in those waters, being of 12,480 tons. The ships to be built on the Neva are of 16,630 tons, and two of them are to be put in hand at once. The Imperator Pauel I, named after the Emperor Paul, is to be laid down at the Baltic Yard, and the Andrei Pervosvannui at Galerny Island. The latter is named after St. Andrew the Apostle, but the literal translation of the name is "Andrew called the First." The title is not new to the Russian fleet there having been a ship so called in the time of Peter the Great. The new ships of the larger class will be 429 feet 9 inches long, with 79 feet 9 inches beam, and 28 feet 6 inches draft, and are intended to steam at 18 knots. They will carry four 12-inch guns, and will be superior to the Cesarevitch in carrying twelve 7.87-inch guns instead of twelve 6-inch. The estimated cost of each of the new vessels is £1,170,400.—*Army and Navy Gazette.*

SPAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Protected Cruisers.			
Reina Regente	5,372	Ferrol.	Building.
Isabel la Catolica	3,500	Canaca.	"

SWEDEN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Coast Defense Battleships.			
Aran	3,650	Gothenburg.	Under trial.
Wasa	3,650	Malmö.	Launched.
Manligheten	3,650	"	Building.
Tapperheten	3,650	Stockholm.	Launched.
Dristigheten	3,650	Gothenburg.	Under trial.
Armored Cruiser.			
Fylgia	4,600	Stockholm.	Building.

TURKEY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Protected Cruisers.			
Abdul Medjed	3,830	Cramp's Shipyard.	Launched July 25, 1903.
Abdul Hamid	3,830	Elswick.	" Sept. 25, 1903.

The following are the particulars of the Ottoman cruiser Abdul Hamid, which was launched at Elswick, September 25. This vessel is of the protective-deck type, has a length of 340 feet, a breadth of 47½ feet, a mean draft of 16 feet, and a displacement of 3830 tons. She is constructed of steel, with a protective deck extending over her whole length, 4 inches thick on the sloping parts, and 1½ inches thick on the horizontal parts; she is fitted with numerous water-tight bulkheads extending to the upper deck. There is also a double bottom subdivided into a great number of water-tight compartments. The armament consists of two 6-inch quick-firing guns on upper deck, eight 4.7-inch quick-firing guns on upper deck, six 3-pounder quick-firing guns on bridges and hammock berthing, and six 1-pounders. Two 18-inch training torpedo tubes are also fitted on the main deck forward. The propelling machinery, now being constructed by Messrs. Hawthorn, Leslie & Co., at St. Peter's Works, is designed to develop 12,500 horse-power, and consists of two sets of vertical triple-expansion engines, using steam of 210 lbs. pressure, generated in six cylindrical multitubular boilers. The speed guaranteed is 22 knots.

UNITED STATES.

VESSELS BUILDING.

No.	Name.	Speed. Knots.	Where Building.	Degree of Completion. Nov. 1.	Dec. 1.
	Battleships.				
11	Missouri	18	Newport News Co.	99 per ct.	99 per ct.
12	Ohio	18	Union Iron Works.	82	88
13	Virginia	19	Newport News Co.	47	50
14	Nebraska	19	Moran Bros. Co.	30	30
15	Georgia	19	Bath Iron Works.	37	40
16	New Jersey	19	Fore River S. & E. Co.	46	48
17	Rhode Island	19	Fore River S. & E. Co.	47	48
18	Connecticut	18	Navy Yard, New York.	21	24
19	Louisiana	18	Newport News Co.	28	31
20	Vermont	18	Fore River, S. & E. Co.	0	1
21	Kansas	18	New York S. B. Co.	5	2
22	Minnesota	18	Newport News Co.	4	8
	Armored Cruisers.				
4	Pennsylvania	22	Cramp & Sons.	60	63
5	West Virginia	22	Newport News Co.	64	67
6	California	22	Union Iron Works.	43	48
7	Colorado	22	Cramp & Sons.	65	67
8	Maryland	22	Newport News Co.	60	63
9	South Dakota	22	Union Iron Works.	41	44
10	Tennessee	22	Cramp & Sons.	10	13
11	Washington	22	New York S. B. Co.	8	9
	Protected Cruisers.				
14	Denver	17	Neafie & Levy.	98	98
15	Des Moines	17	Fore River S. & E. Co.	94	96
16	Chattanooga	17	Lewis Nixon.	74	73
17	Galveston.	17	Wm. R. Trigg Co.	68	69
18	Tacoma	17	Union Iron Works.	93	96
20	St. Louis	22	Neafie & Levy.	32	34
21	Milwaukee	22	Union Iron Works.	35	38
22	Charleston	22	Newport News Co.	58	58
	Gunboats.				
17	Dubuque	12	Gas Engine & Power Co.	10	15
18	Paducah	12	Gas Engine & Power Co.	9	13

STEAM TRIALS.

BELLEVILLE BOILERS AND THE NAVAL MANŒUVRES.—In view of the recent controversy as to the efficiency of Belleville boilers some interesting facts are brought to light as to their value by a correspondent who was present at the manœuvres. He says that no fewer than 21 battleships and large cruisers which took part in these operations depended for their steam supply on these French generators. During the stay of the combined fleet at Lagos, he took special pains to enquire how they had come out of the most severe test to which so large a collection of men-of-war has ever been submitted. As has been already reported, the fleet was not without its "lame ducks," and the Blake's Scotch boilers in particular were the cause of a most deplorable loss of life; but although the 21 Belleville ships covered over 2000 miles each, and many of them considerably more, he could not learn that in a single instance the boilers had developed defects worthy of mention. None of these ships were compelled to drop out of the manœuvres, even temporarily, by reason of trouble with their boilers. In view of the alarming statements which have been made from time to time this assurance may be accepted by the nation with a feeling of relief.

These ships are not "lame ducks," as has been repeatedly represented. On the contrary, they have shown themselves to be good, reliable steamers, far superior to ships fitted with the older type of generator, and possessing

the great militant quality that they are able to put on their full speed at short notice. The Good Hope increased her steaming from 9 to 19 knots in less than ten minutes, and in a very short time she was traveling at 22½ knots, maintaining this rate with perfect ease for four hours. The secret of success in working this new kind of boiler lies in the intimate knowledge by the engineers and the staff of its peculiar qualities. It is undoubtedly a type which needs careful handling and much attention and unremitting vigilance. Where these conditions are fulfilled it does well. —*Iron Age.*

The cruisers Medea and Medusa arrived at Plymouth on Monday, after a successful run from Gibraltar, which was carried out for the information of the boiler committee. The cruisers had a good run home and the race was a keen one from start to finish. Each cruiser had four boilers in operation. At the start, the Medusa got half a mile ahead, and leading throughout, she won by three minutes. During the Friday the Medea got up, but within six hours three of her fans failed, and by Sunday morning the Medusa had a lead of nine miles. Then the Medea, her fans having been repaired, began to creep up, and the distance between the two ships was gradually lessened. At 6 o'clock in the evening the Medea was only a mile astern. The scene in the stokeholds of both ships was then very exciting, even the officers assisting in stoking and passing coal. By 9 o'clock the Medea had made up the leeway to three-quarters of a mile, and by this time the Eddystone, the finishing point of the race, was only 60 miles away. Although the crew of the Medea worked their hardest they could not overhaul the Medusa, which rounded the Eddystone at five minutes after midnight, the Medea following five minutes later. When allowance is made for the Medusa's start she actualy won by three minutes. The Medusa is fitted with water-tube boilers of the Durr type, and the Medea with large tube boilers of the Yarrow water-tube type.—*United Service Gazette.*

THE "WAR TRIALS" OF H. M. S. EUROPA. (From our own correspondent).—As a compliment to the details I recently gave of the "war trial" cruises of the Spartiate and Europa, the following may be of interest to those who follow the battle of the boilers:

At the conclusion of her voyage to Hong Kong and back, the Europa remained fourteen days at Portsmouth. No repairs were effected in her Belleville boilers during this period. She was then sent to sea for the manœuvres with a mobilized crew. These were purposely selected at haphazard and of one hundred and twenty stokers, sixty were raw second-class stokers who had not been to sea before.

During the manœuvres she steamed 5600 miles, and burned 2500 tons of coal. For the first eighty-eight hours of the "war" she had all boilers continuously in use, and for fifty-eight hours on stretch was at top speed. At high speeds her average consumption per indicated horse-power was from 1.9 lb. to 2 lb.

During the "war" no defects of any sort occurred, but on the voyage home an indicator pipe exhibited a slight crack. Many of the raw stokers were sea-sick in the earlier stages of the cruise, and for twenty hours the remainder had to be put into two instead of three watches. In this way no difficulty was experienced in maintaining speed with the proper engine-room complement. Only the usual deck hands were below trimming coal in the bunkers—forty-eight men in three watches. No deck hands were employed on the fires, the boilers being kept going entirely by those stokers who were not incapacitated by sea-sickness.

No defects of any sort other than the indicator pipe already mentioned were noted at the expiration of the trip. The total trial mileage was thus brought to over 25,000 miles of practically continuous steaming, the fortnight's delay at Portsmouth having been caused by the ship reaching Portsmouth sooner than had been expected from the China trip.

There was no appreciable loss of water, and ample quantities were always available.

A point of special interest in connection with the Europa is that all

except the three top rows of her boiler tubes are the original tubes, now some five years old.

The practice was to use lime, so as to coat the insides of the tubes; forced draft was then employed on all possible occasions. This is the exact opposite of the system employed in the Spartiate, but both seem to have been equally satisfactory.

The supreme value of these trials, as opposed to the Hyacinth-Minerva trials, is that they were under "war conditions." This, amongst other things, such as raw stokers, chance staffs, and coal "as it comes," means that a ship while doing full speed is liable to be stopped dead at any moment, with, of course, a corresponding strain upon the boilers. In theory, of course, such strains should not be given, but till naval captains know a good deal more about naval engineering than they do at present, boilers will always have to stand the chance. In action, too, such sudden stops will have to be made, and boilers that cannot stand it must go to the scrap heap, whatever other virtues they may possess. We can hardly, therefore, quarrel very much with the imposition of such "savage tests" in peace manœuvres, especially when these form part of a "war trial." Indeed, it is to the national advantage that they should be made, and it is satisfactory to record that the Europa's boilers—despite their age and their special condemnation by the Boiler Committee—came through the test with complete success.—*Engineer.*

The armored cruiser Cumberland of the County class of ships has recently completed her official trials with the most satisfactory results. This vessel belongs to the second series of ships of this class which have proved more successful than the earlier vessels, largely as a consequence of the results of the trials of the latter influencing the propeller designs, and the designed speed of 23 knots has been exceeded by something like 0.5. The Cumberland is a vessel 440 feet long, 66 feet beam and with a mean draft of 24 feet 6 inches, the displacement, 9800 tons. She has 4-inch armor on the broadside, and is armed with fourteen 6-inch guns, and thirteen smaller quick-firers. The engines, which are of the triple-expansion type with four cylinders, were designed to run at 140 revolutions—equal to a piston speed of 980 feet per minute, to give a power of 22,000 I. H. P. The high-pressure cylinder is 37 inches in diameter; the intermediate, 60 inches; and the two low-pressure are each 69 inches; the piston stroke in all cases being 42 inches. The boilers are of the Belleville type, 31 in number, and it may be said here that these worked quite satisfactorily throughout the series of trials. The results are given in the appended table:—

Steam Trials of H. M. S. Cumberland in the Irish Sea.

Date			**August 26th and 27th. 30 hours at one-fifth power.**		**August 29th and 30th. 30 hours at eight-elevenths power**		**September 2nd. 8 hrs. at full-power.**	
			Forward.	**Aft.**	**Forward.**	**Aft.**	**Forward.**	**Aft.**
Draft of water			24 ft. 1½ in	25 ft. 1 in.	24 ft. 1 in.	25 ft. 1 in.	24 ft.	25 ft. 1 in.
Steam in boilers			240 lbs.		274 lbs.		296 lbs.	
			Starboard.	**Port.**	**Starboard.**	**Port.**	**Starboard**	**Port.**
			fwd. aft.	fwd. aft.				
Vacuum			27 in. 27 in.	27½in.27½in.	27 in.	27½ in.	26½ in.	26½ in.
Revolutions per min.			89.6	87.8	132.9	132.8	145.2	143.7
Mean pressure.	**High**		41.3 lbs.	40.7 lbs.	94.6 lbs.	97.6 lbs.	108.2 lbs.	106.3 lbs.
	Intermediate.		15.15 "	15.7 "	29.1 "	32.1 "	41.25 "	41.8 "
	Low forward.		5.9 "	6.06 "	13.2 "	14.0 "	19.06 "	18.8 "
	Low aft		5.4 "	5.6 "	13.32 "	13.9 "	18.84 "	19.03 "
I.H.P.	**High**		844	816	2,855	2,970	3,484	3,420
	Intermediate.		815	828	2,317	2,560	3,594	3,599
	Low forward.		418	421	1,401	1,474	2,194	2,179
	Low aft		382	389	1,410	1,465	2,170	2,149
Mean total I. H. P.			2,459	2,454	7,983	8,469	11,442	11,347
Collective I. H. P.			4,913		16,452		22,769.	
Mean air pressure			Nil		Nil		·2 in.	
Speed of vessel on measured mile			15.241 knots.		22.136 knots.		23.7 knots.	
Coal consumption per I.H. P. per hour			2.1 lbs.		1.98 lbs.		2.01 lbs.	

It will be noted that in all cases the vessel was at her mean low draft, and that the speed for one-fifth power (4913 I. H. P.) was 15.24 knots; for 16,452 I. H. P. it was 22.138 knots; and at full power (22,769 I. H. P.) it was 23.7 knots which is exceptionally satisfactory. The coal consumption during the three trials averaged about 2 lbs. per I. H. P. per hour. On the eight hours' full-power trial, the power indicated by the engines ranged between 21,981 I. H. P. and 23,500 I. H. P., the latter during the third hour of the trial; this was with the engines making a mean of 145.5 revolutions, and with a mean steam pressure at the engines of 230 lbs. During the 30 hours' trial at 22 knots special observation was made as to the water consumption, and it was found that the water used by the main engines worked out to a mean of 15.40 lbs. per I. H. P., and by the auxiliary engines to 1.77 lbs., giving a total of 17.17 lbs. per I. H. P. per hour. The total loss of water was equal to 2.965 tons per 1000 H. P. per 24 hours; but the whole of this was made up during the trials, and is included in the coal consumption, the evaporators in the 30 hours producing 65.5 tons, which considerably exceeded the actual loss.

The second-class cruiser, Challenger, built at the Chatham Dockyard, has just completed her official trials, which are of peculiar interest in view of the fact that she is the first cruiser built originally with Babcock and Wilcox boilers. Special arrangements were made for measuring the water consumption, as well as the amount of fuel used on the respective trials. The vessel is of 5880 tons displacement, with a mean draft of 21 feet 3 inches, the length between perpendiculars being 355 feet. She is of the protected-deck type, and mounts eleven 6-inch breech-loading guns, with fifteen smaller quick-firers. But the chief interest is associated, as we have said, with the machinery installation. The contractors for the machinery were the Wallsend Slipway and Engineering Company, Limited, Newcastle-on-Tyne, and they gave the order for the boilers to the Babcock and Wilcox Company. The engines are of the triple-expansion four-crank type, the high-pressure cylinder being 28 inches in diameter; the intermediate, 45 inches; and the two low-pressure cylinders each 52 inches. The stroke is 32-inch.

There are 18 boilers in the ship, the collective grate area being 881.2 square feet, and the total heating surface 31,872 square feet. The trials were conducted during stormy weather, but the ship behaved well, and the machinery worked most satisfactorily. As usual, there was a 30-hours' trial at about one-fifth power, a run of the same duration at about 70 per cent of the total power, and an 8-hours' trial at the full output of 12,500 H. P. The results are set out in the appended table:—

Results of Official Trials of H.M.S. Challenger.

Total grate surface ..... 881.2 square feet.
Total heating surface ..... 31,872 "

——	8 hours.	30 hours.	30 hours.
Revolutions per minute	176.9	160.1	105.6
I. H. P.	12,781	8,972	2,636
Coal consumption per I. H. P. lbs.	1.78	1.74	1.75
Water " " "	17.5	17.6	....
Steam pressure "	242	241	241
Draft " in.	.84	.3	Nil
Heating surface per I. H. P. sq. ft.	2.49	3.55	6.04
Coal per square foot of grate area per hour lbs.	25.8	17.7	10.48
Water evaporated per square foot of heating surface.. "	7.02	4.9	3.59
Water evaporated per lb. of coal "	9.84	10.1	....

It will be noted that the coal consumption varied only between 1.74 lbs. and 1.78 lbs. per I. H. P. per hour, and that the steam consumption of the engines was remarkably uniform at 17.5. It should perhaps be noted,

althoug well known to all acquainted with naval practice, that both coal and water consumption is for the whole of the machinery on board; while the H. P., upon which the rates of consumption are based, is the actual power developed only by the main engines.

STEAM TURBINES.

Turbines for Ocean Liners.—The Cunard Company have, in conjunction with the Admiralty, appointed a commission to inquire into the whole subject of the turbine and its adaptability to ocean service, for their new Atlantic liners. The Parsons and Rateau turbines are being fully examined, and the Curtis turbine can hardly be ignored—which in America is in high favor for power stations—although it has only as yet been fitted to one ship. A turbine which is coupled to an electrical generator of 5000 kilowatt capacity is practical proof that electrical engineers are satisfied of its efficiency. In the Curtis turbine the shaft is vertical, and the whole weight of the revolving part is borne by an oil film delivered by a pressure pump to a lower bearing. The delivery of steam to the turbine is controlled by a system of electrically operated individual valves worked on a small controller, a centrifugal governor moving a controller. This turbine and electric generator stands 25 ft. high, and is 14 ft. in diameter. The total weight of the turbine and generator is about 400,000 lbs. It does not follow, however, that a system of proved success for land service will be found effective for marine service.

Meanwhile, the Allan Line have decided to adopt the turbine in the Canadian service. Lord Strathcona, on his return from Canada, stated that the proposed fast steamship service between Canada and Britain had not been dropped. The question was then under consideration by the Canadian Government, and he looked forward to the proposal being carried out at no distant date. They had to recognize, he said, not only the possibility, but the practicability of the turbine for trans-Atlantic steamers. There was no doubt that it had made rapid strides, and the question of a fast steamship service to Canada could not be settled without taking the turbine into consideration. It is now announced that Messrs. James and Alexander Allan, Glasgow, have placed with Messrs. Workman, Clark and Co., Ltd., Belfast, an order for a new turbine steamer for their Liverpool to Canada mail and cargo service. This vessel, which is to be ready in the course of next year, will be of about 12,000 tons, and will have a speed of 17 knots. She will thus be one-fifth larger than the Tunisian or Bavarian, which are the firm's present largest vessels, and about two knots faster. She is to be fitted with Parsons' turbines instead of with reciprocating engines. Messrs. J. and A. Allan have been considering the question of turbines for some years, and have now decided to take the important step of fitting them into a first-class Atlantic liner. The United States Navy authorities have also appointed a commission to examine carefully all available data with regard to the working of turbines, to inspect vessels in which they have been installed, and to prepare an estimate to be submitted to Congress in connection with the proposal to fit a war vessel of 5000 tons with turbines. It is expected that this commission will arrange for the fitting of turbines to a torpedo boat for careful tests. The only turbine-driven boats in United States waters are yachts—one, the Revolution, with a Curtis turbine of American make; a second, the Emerald, built for Sir Christopher Furness by Messrs. Alexander, Stephen & Son, of Glasgow, and subsequently bought by Mr. George Gould; and the third, the Tarantula, constructed by Messrs. Yarrow for the late Colonel M'Calmont, and now owned by Mr. Vanderbilt.—*Page's Magazine.*

MANŒUVRES.

The official report on the naval manœuvres of this year has been issued, with the umpires' opinion on the result annexed. The umpires who sign the document are Vice-Admiral Sir Lewis Beaumont, Rear-

Admirals Barlow and Hamilton, and Captain A. G. H. W. Moore, secretary. It is pointed out that the object of the manœuvres is contained in the general idea, and was understood by all who took part in the operations to consist (1) of the endeavor of "B" to combine his force "B 1" from northern waters with his available forces, "B 2," at Madeira; and then (2) to engage "X," known to be concentrating at Lagos, with the object of wresting from him the command of the sea which he held in those waters. After a detailed consideration of the movements and actions, with their outcome on both sides, the umpires conclude: "We are of opinion that at the end of the manœuvres the command of the sea in those waters still remained with 'X.'" The principal reasons which induced the umpires to arrive at this conclusion appear to be that the undamaged portion of "X" fleet was much superior to the undamaged portion of "B," that "B" in effecting the junction had expended more coal than "X," that "B 1" was further from its base than "X" fleet was from Gibraltar, and that on the morning of the 11th (that is to say, the morning of the day on which hostilities were to cease) "X" had joined his missing battleship and armored cruiser, though he had lost the Venerable by a machinery breakdown. We do not suppose that this decision of the umpires will be accepted by everybody without question; at the same time, it is well that we should know what their views are, and we have to thank them for making them public with such commendable promptitude.

MISCELLANEOUS.

FLEETS IN THE FAR EAST.—It will be of interest to consider at the present moment the composition of the naval forces of Russia and Japan, and especially as regards the Russian warships concentrated in the Far East. A recent official paper, quoted by the *Times*, is the basis of the following list of Russian ships. At Vladivostok the following vessels were assembled last month: Battleships—Petropavlovsk, with her sister-ships Poltava and Sevastopol. These three dating from the early nineties, are of 10,950 tons displacement, can steam at 16 knots, and carry four 12-in. and twelve 6-in. guns. The Peresviet, Pobieda, and Ossliabya, another class of 12,700 tons, date from 1895. These are credited with a trial speed of 18.5 knots. Their armament is four 10-in., ten 6-in., and twenty 12-pdrs. There is, further, the Retvizan, of 12,700 tons, 16,000 H. P., and 18.8 knots speed, mounting four 12-in. and twelve 6-in. guns, and the Cesarevitch of 13,000 tons, designed in 1899, which mounts a similar armament, is outward bound. Thus Russia has eight battleships on the China station, of which three are of what we should designate as the second class. No doubt the Imperator Nicolai I, another second-class battleship now in the Mediterranean, could be despatched with rapidity, and it is stated that the Alexander III will go out. Turning to the Russian cruisers on the station we find the armored ships Rurik (1890), Rossia (1893), and the sister cruisers Pallada and Diana, as well as the Varyag. These latter are of 6630 tons, and twenty knots speed. There are also the armored cruisers Gromoboi and Bayan, sister ships of 12,336 tons, twenty knots speed, and of modern build. Of large protected cruisers on the station Russia has five with two of the second class, and three of an older and smaller type. There are, further, two torpedo gunboats, several gunboats distributed along the coast, and an unknown number of destroyers in Port Arthur. It will be seen that the Russian fleet is not homogeneous, and that the speed of the battle fleet may be reduced to sixteen knots or less by the inclusion of several battleships which are not of the latest types. There are practically only four first-class battleships, two of which are laid down in 1895.

Japan, of course, has her entire navy concentrated in her own waters. Her principal ships are six battleships of large displacement—12,000 to 15,000 tons—of which the two, Yashima and Fuji, date back to 1894. The Mikasa, Hatsuse, Asahi, and Shikshima, are all modern and over

15,000 tons displacement, and they are faster than the best of the Russians. Japan has also the two small battleships, Chen Yuen and Fusoo, and four coast-defense armor-clads. She has six armored cruisers, grouped as follows: Asama and Tokiwa (9750 tons), Idzumo and Iwate (9800 tons), and the Yakumo and Adzuma (9456 tons). All of these were laid down in 1898-99, and they constitute a homogeneous cruiser squadron of high speed. There are sixteen protected cruisers of various dates and nineteen destroyers. Relatively, it will be seen, there is no great difference in the strength of these fleets, whether in battleships or armored cruisers. There is higher speed and more homogeneity in the Japanese fleet, and Japan is also better provided with coaling stations in Eastern waters. The Japanese coast-defense ships are all of about 2000 to 2500 tons displacement, and would be of slight value.

It would seem probable that a sea struggle between Japan and Russia, and with the fleets here considered, would be largely decided by the training of the *personnel*. We have no clue whatever as to the efficiency of the Russian *personnel* in the form of practical experience. One knows, however, that the Japanese proved dashing and efficient in their last war against China. It would be premature to consider what may happen in the China seas should the present crisis lead to war, but it is plain that any operations on land must be preceded by a contest between the fleets, and it would require a bold prophet to forecast the results.—*Army and Navy Gazette.*

In connection with the arrival of the battleship Duncan at Gibraltar, after a successful run to that port with Mr. Marconi as a passenger, it is officially stated that from October 24, the date on which the vessel left Portsmouth, messages were received on board daily during the trip. The weather was exceedingly rough in the Bay of Biscay, and one of the special wireless telegraph gaffs which had been fitted to the topmasts to support the elevated conductors connected to the special Marconi instruments was carried away. Notwithstanding that this mishap necessitated a considerable reduction in the height of the masthead wires, the reception of messages on board continued in an uninterrupted manner. The messages generally consisted of ordinary current news bulletins and a few private messages; but on October 29, the day the ship arrived at Gibraltar, an official message of instructions to Captain Jackson from the Admiralty was received on board. During the stay of the Duncan at Gibraltar, from October 28 until November 3, various other tests were carried out with the object of ascertaining the relative efficiency of different forms and arrangements of aerial wires. Messages were always received at the anchorage from England with regularity when the arrangement which Mr. Marconi had anticipated would be necessary for the purpose was used. Numerous tests were also carried out between Poldhu and the Marconi Naval Station situated on the Rock at Gibraltar. Messages were correctly received at this station (notwithstanding that the whole of Spain intervened between it and the station in Cornwall) in the presence of Rear-Admiral Sir William Acland, Captain Jackson, and several other officers. On November 3 a complimentary message was received at the Gibraltar wireless station from the directors of the Marconi Company, addressed to the Governor of Gibraltar, and duly delivered. These tests were watched on board the Duncan on behalf of the Admiralty by Captain Jackson, and at the Poldhu station by Lieutenant F. G. Loring, R. N. The result of these tests has been to prove further the possibility of communicating by means of wireless telegraphy from England to Gibraltar, a feat which was first achieved during the experiments which Mr. Marconi carried out in the Italian cruiser Carlo Alberto in September, 1902, and to prove also that considerable areas of land and high mountains do not prevent the transmission or reception of messages by means of wireless telegraphy when suitable means are employed. It was also ascertained that the ordinary short distance Marconi instruments supplied to the Admiralty were not interfered with or affected by the action of the electrical waves radiated from Poldhu.—*United Service Gazette.*

THE ADMIRAL'S FLAG.

By "TELESCOPE."

(*From The United Service Magazine.*)

In an article, "The National Flag," published in the June number of this magazine, I attempted to bring together a few little-known facts about our national flag and ensigns, and it is my purpose in this short article to perform the same service towards the admiral's flag.

An admiral's flag is his personal banner, hoisted with the colors on the day he takes command of his fleet or squadron, and hauled down at sunset of the day on which he relinquishes his command.

It denotes his presence in the squadron, though not necessarily on board his ship, and is flown continuously, night and day, during the period of his command, except when he proceeds on leave of absence for more than forty-eight hours.

It further denotes the rank of the admiral, whether full, vice, or rear, by the mast on which it is worn—or, in modern ships, where there are usually only two masts, one of them being occupied by the mast-head semaphore, by the absence or addition of red balls in the two cantons or divisions of the flag nearest the mast. The absence of these balls denotes a full admiral; one ball a vice-admiral, and two balls a rear-admiral.

In the flagship the admiral's flag, charged with the proper number of balls, is invariably used as the badge of the boats of that ship. The boats of all other ships being distinguished by an initial, a crest, or some other device. Thus, to quote a few instances, the Polyphemus used to wear an eye, the Prince George wears a Tudor rose, the Sutlej the heraldic device signifying a river, and the Gibraltar the arms of that fortress, the castle with three towers and dependent key; while the majority of private ships distinguish their boats by an initial.

In confirmation of the idea that the flag is personal, it may be stated that instances have occurred where a silk flag of the proper device has been presented to an admiral in command by the officers and men of his flagship, or by those of his fleet; and such phrases as "my flag," "your flag," are frequently found in official correspondence.

The personal nature of the flag is borne out by reference to history. From ancient times it was the custom for the leader of an army to have his flag, and when heraldry had developed, it was covered with his coat-of-arms. In the sea service, ships sailed under the flag of the admiral, so that this flag is even more ancient, at any rate in its use afloat, than the national flag.

"The sea is one," and the following extract from the Book of War, of Jehan Bytharne, is interesting, as showing the custom in France in 1543.

"As touching the ornamentation of your ship, on the outside, from the main wale on the water-line to the top of the castles, she ought to be painted in your colours and devices, as also the forecastle and the after-castle, as splendidly as may be. And all the shields round the upper part of the castles—as well the forecastle as the aftercastle—ought to be emblazoned with your arms and devices. And above the forecastle, on a staff inclining forwards, you ought to have a pennon of your colours and devices; as also at the two corners of the castle. Amidships there ought to be two square banners emblazoned with your arms. On the aftercastle, high above the rudder, you ought to have a large square banner, larger than any of the others. And on each side of this castle, as you face towards the mast, there ought to be five or six square banners, not so large as that above the rudder, which I have just spoken of, all emblazoned with your arms, quarters, and devices. All round the maintop—*videlicet* of the mainmast—you ought to have top-armour of the full depth of the top, and emblazoned with your arms; and from it there must fly a broad swallow-

tailed standard, of such length as to reach to the water, and similarly emblazoned with your arms. And no one is permitted to carry such a banner on the maintopmast except you; for it is by it that you are recognized by day. Likewise on the foremast there ought to be a top, with top-armour all round, like to that of the maintop. And above there ought to be a pennon like to the great standard, but not nearly so long." *

All this paraphernalia to denote the rank and consequence of an admiral has long since passed away, but it should be remembered that our junior grades of admiral now bear as their flag the ancient banner of England, the plain white flag charged with the red cross of St. George, while the highest grade—an admiral of the fleet—hoists the present national flag, the union jack, as his device, and this appears only fitting for the chiefs of that navy "whereon, under the good providence of God, the wealth, safety, and strength of the kingdom chiefly depend," to quote the preamble of the Naval Discipline Act.

The practice of hoisting the admiral's flag at a certain mast to denote his rank is of considerable age. In the quotation from Jehan Bytharne's work, which was presumably addressed to Annebaut, Admiral of France, it is seen that it was the custom of the sea that the chief commander should wear his flag at the main. "And no one is permitted to carry such a banner on the maintopmast except you; *for it is by it that you are recognized by day.*"

Half a century later, in 1596, at the time of the voyage to Cadiz, there were four English squadrons, each with three admirals; an admiral, a vice-admiral, and rear-admiral: and thanks to drawings attached to the manuscript relation of the voyage by Sir William Slyngisbie, recently published in Vol. I of the "Naval Miscellany," (Navy Records Society) we find not only the flags, but their positions.

In each squadron the admiral flew his flag at the main, the vice-admiral at the fore, and the rear-admiral at the mizzen; just as would be the case to-day if three masts were available for the purpose.

In this expedition, as in that of the Duke of Buckingham's expedition, to the Isle of Rhé in 1627, the admiral in chief command of the fleet, the lord admiral, Lord Howard of Effingham, flew the royal standard as his flag, or as is quaintly described in Pepys' report, he was "Admirall particular of the bloody colours."

The other admirals of his squadron flew peculiar flags. They were striped horizontally from top to bottom, red, white, blue, red, white, blue, red, with the red Saint George's Cross on a white field, occupying the upper quarter or canton nearest the mast.

The Earl of Essex commanded the second squadron, and he flew the admiral's flag, a large white flag with the Saint George's Cross. The white field of the flags of the admirals serving under him was crossed horizontally by blue stripes, so that they appeared as white and blue flags with the Saint George's Cross surcharged.

Lord Thomas Howard, the commander of the third squadron, and the admirals under him, flew flags similar to those of the admirals of the lord admiral's squadron, except that the red, white, and blue stripes were replaced by green and white stripes, the Tudor colors.

In the fourth squadron, commanded by Sir Walter Raleigh, the flags were plain white.

The red, white, and blue stripes of the flags of the lord admiral's squadron are curious, because they bear no relation either to the lord admiral or to the royal standard; and yet it is but reasonable to assume that they had some significance, because for this fleet four large flags were ordered, one white, one orange-tawny, one blue, and one crimson.

White is the field of the national flag, as it was at that time; red or crimson is the color of the Cross of Saint George, and also of two cantons

* "The Naval Miscellany," Vol. I, Navy Records Society.

of the Elizabethan Royal Standard, while blue is the color of the other two quarters, and it requires but a small stretch of the imagination to mingle the two flags to make the first of our red, white, and blue flags. The orange-tawny flag was, no doubt, ordered for Essex, whose color it was.

If this be the origin of our "red, white, and blue," it is far more "national" than that of France. The ship described above decked in flags, banners, pennons and streamers, painted on her sides and top-armor, was colored red, white and blue, because these were the colors of Annebaut, Admiral of France, whose arms were "gules, on a cross argent, twelve pieces of vair affronted."

(Webster gives as an explanation of "vair:" "It is represented in heraldry by a series of small shields placed close together, and alternately white and blue.")

When the admiral's flag flew at a certain mast denoting his rank, it was always easy to distinguish the commander-in-chief; but nowadays it is not so easy, as the red balls are not such a prominent distinction.

Recently we have had as many as eight admirals present in the same harbor, with their flags flying all at the same mast. This is confusing enough at anchor, but would be far more so in a fleet under way, and manœuvring, and it is quite possible that when next a large fleet goes into action, the commander-in-chief may devise some means for making himself known, just as Lord St. Vincent, prior to the battle of the Nile, ordered Nelson to fight his ships under the white ensign in spite of the fact that he being a rear-admiral of the blue they should have flown the blue ensign.

I am greatly indebted to the Navy Records Society's publications for assistance in this article.

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut-Com. A. D. Brown, U.S.N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U.S.N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U.S.N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U.S.N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U.S.N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U.S.N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U.S.N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U.S.N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. F. Chadwick, U.S.N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U.S.N.

1883.

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"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U.S.N.

"CUILIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U.S.N.

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1885.

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1886.

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1887.

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1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U.S.N.

1891.

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U.S.N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U.S.N.

1892.

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

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1896.

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1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U.S.N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U.S.N.

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Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

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CONTENTS.

	PAGE
The Fleet. By Rear-Admiral H. C. Taylor, U. S. N.	799
Naval Administration, III. By Rear-Admiral S. B. Luce, U.S.N.	809
Correspondence. A Personal Letter. By Captain C. F. Goodrich, U. S. N.	823
War as the Ultimate Form of Economic Competition. By Mr. Brooks Adams.	829
Automobile Torpedoes; Their Use and Probable Effectiveness. By Lieut. Lloyd H. Chandler, U. S. N.	883
Discussion,	906
Historical Instances of Scouting. By Captain C. F. Goodrich, U. S. N.	917
Nathaniel Bowditch. By Lieutenant G. W. Logan, U. S. N.	927
War Signals. By Commander Bradley A. Fiske, U. S. N.	931
The Accuracy and Probability of Gun-Fire. By Prof. Philip R. Alger.	935
The Sumner Line of Geographical Position and the Compass Error Serviceably Deduced by Inspection. By G. W. Littlehales	953
Professional Notes,	967
List of Prize Essays,	997
Officers of the Institute,	1001
Special Notice. — Naval Institute Prize Essay, 1904	1002
Advertisements.	

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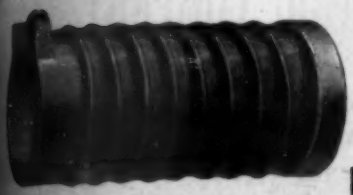

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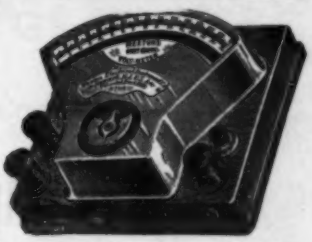

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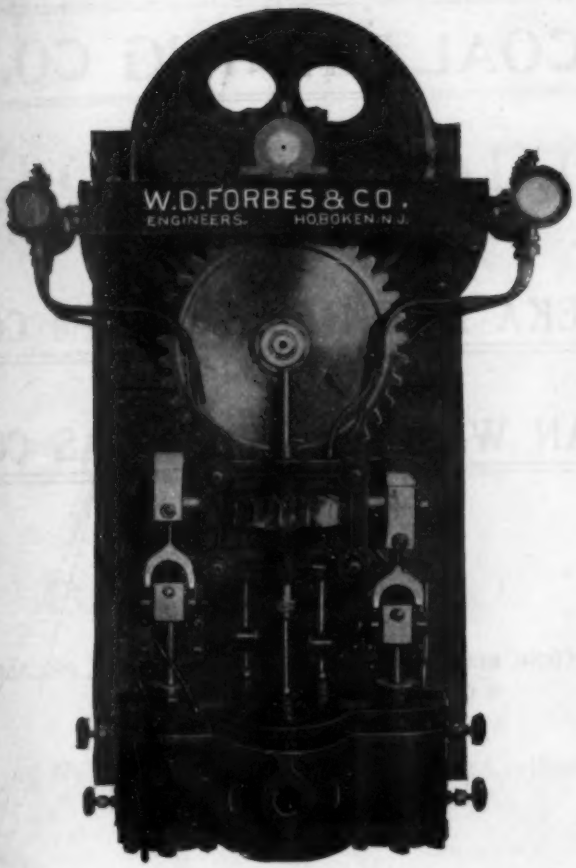

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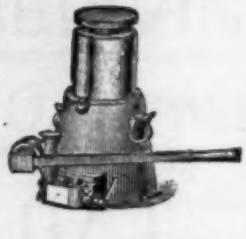

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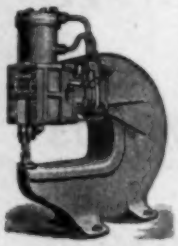

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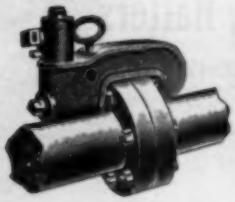

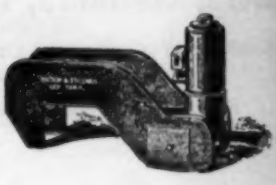

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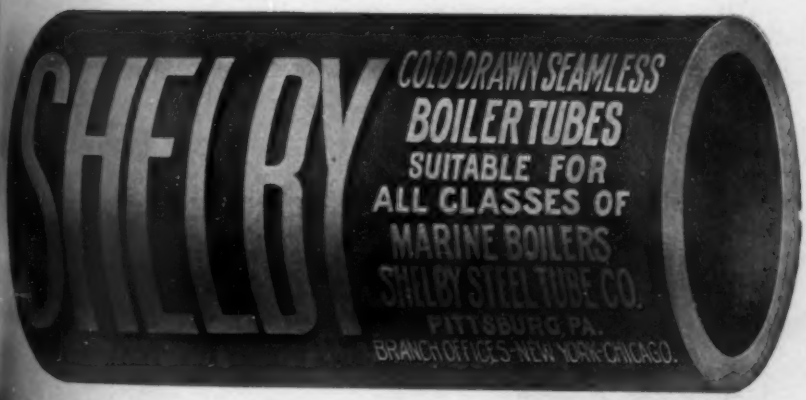

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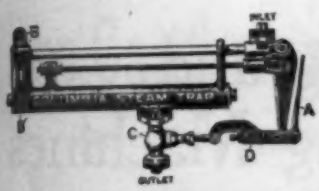

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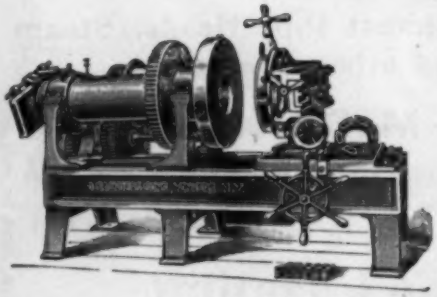

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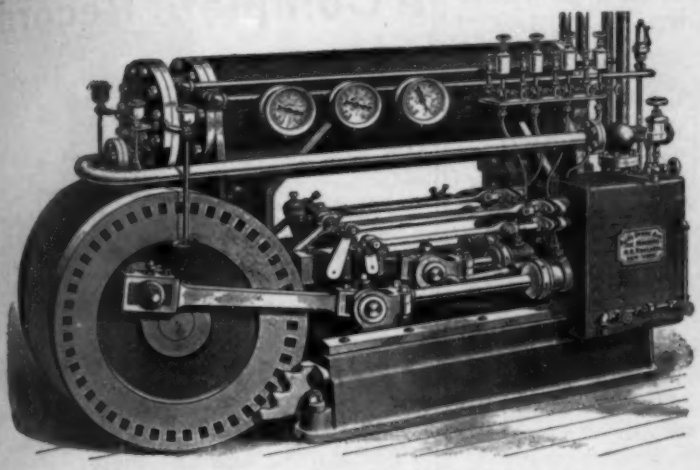

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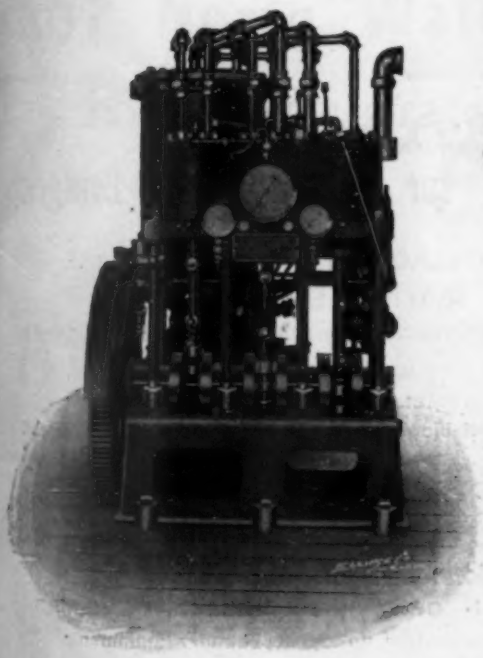

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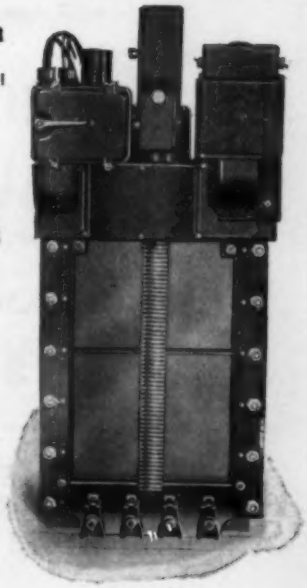

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No. 650,758, May 29, 1900.	No. 719,235, January 27, 1903.
No. 652,970, July 3, 1900.	No. 725,570, April 14, 1903.
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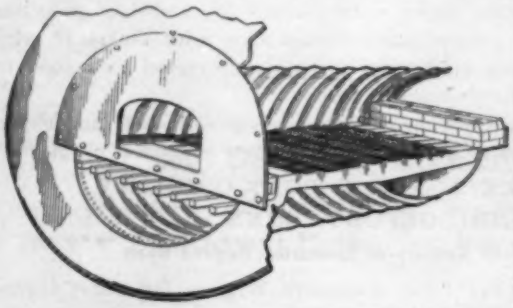

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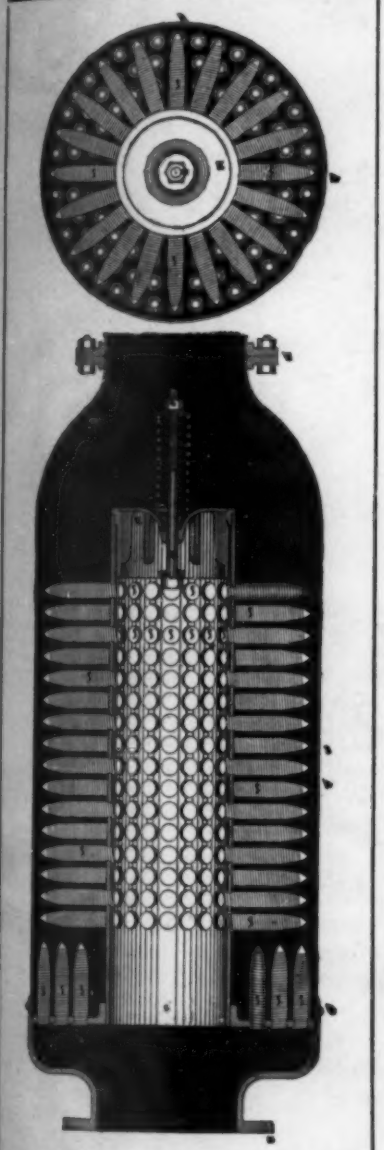

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